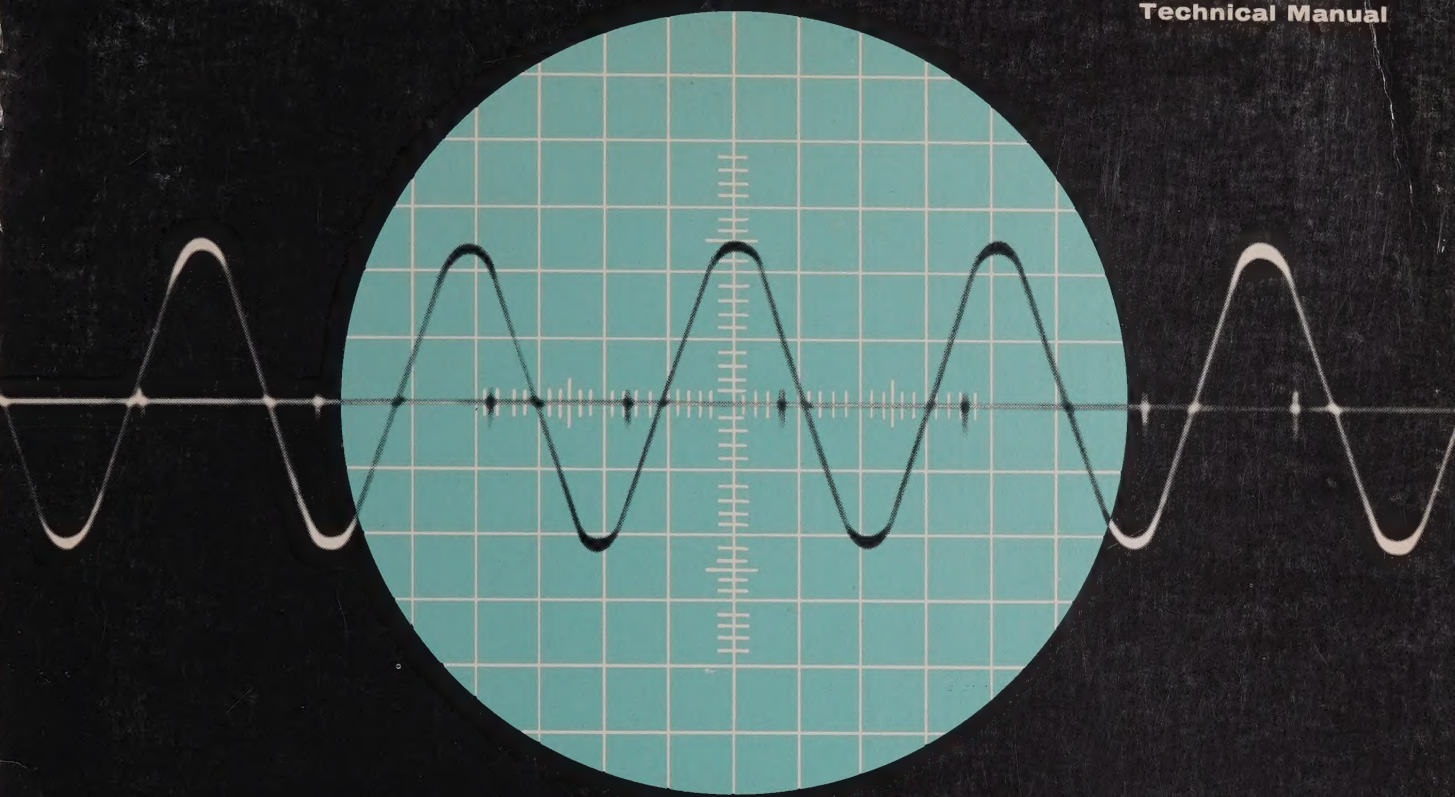
Technical Manual



# PRECISION
# SWEEP SIGNAL GENERATOR
## MODEL 900C

JERROLD
ELECTRONICS CORPORATION
GOVERNMENT AND INDUSTRIAL DIVISION
PHILADELPHIA, PENNA. 19105

# SWEEP SIGNAL GENERATOR

## MODEL 900-C

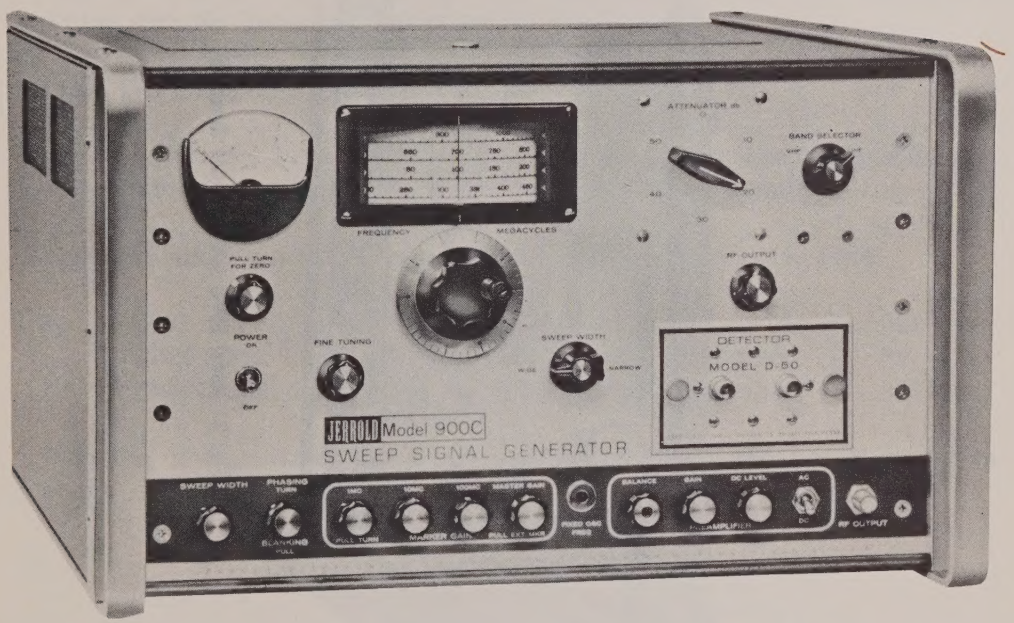



**Fig. 1—Sweep Signal Generator Model 900-C**

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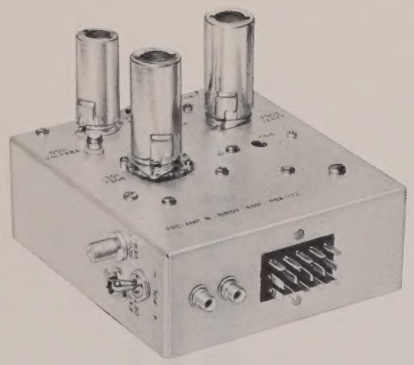
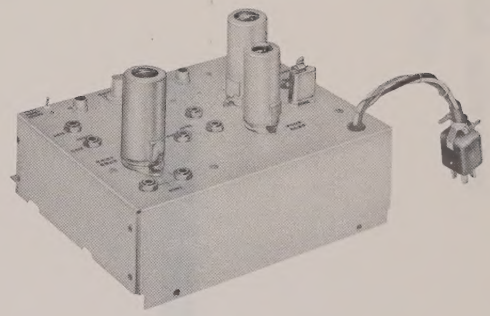


Preamplifier and
Birdy Amplifier



Harmonic Marker Generator

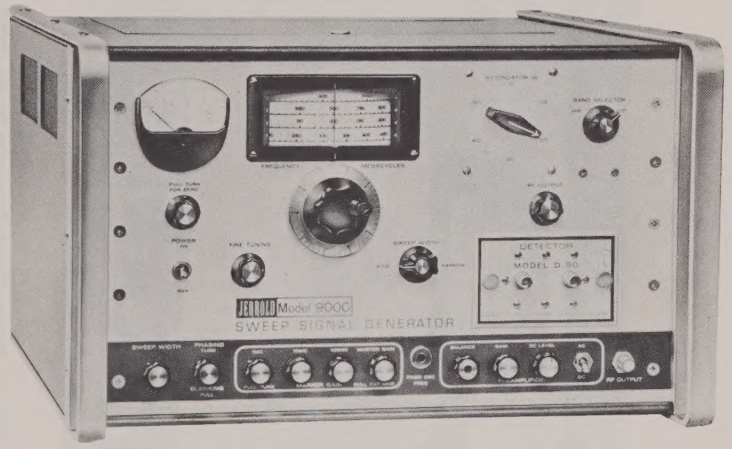
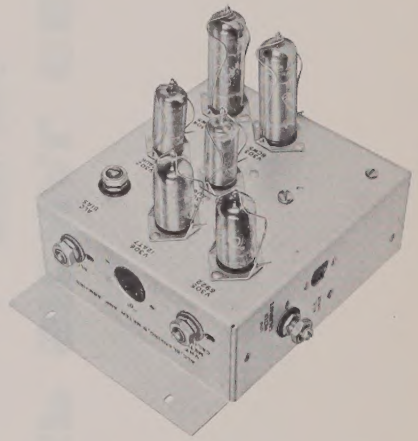
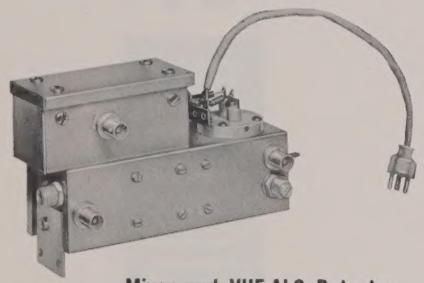



Fig. 2—Model 900-C with Modules Removed



ALC Amplifier, Blanking Circuit
and Meter Amplifier



Mixer and VHF-ALC Detector

JERROLD®

INSTRUCTION MANUALS
435-307.3 and 435-505
AMENDMENTS A1

# SWEEP SIGNAL GENERATORS
# MODELS 900-B and 900-C

These amendments correct and supplement information published in Instruction Manuals 435-307.3 and 435-505.

1. Page 32: change caption on Fig. 52, to read, "Fig. 52-Response of 16 mc Filter with No Reference Attenuation."

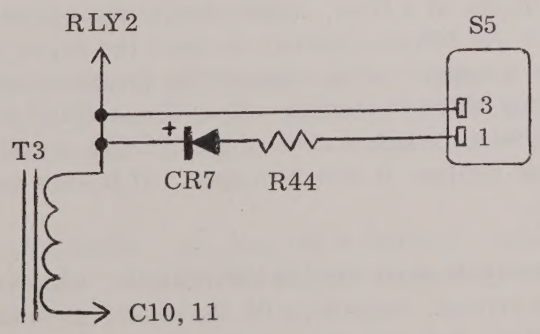
2. Page 49: change "RS27", at the front panel, to "R527".

3. Page 54: change Physical Location entry for Component Designations 801-899 to read, "External Marker Inserter Sub-Assembly."

4. Pages 54 and 55: change the following Parts List items to read:

| | | | | |
|---|---|---|---|---|
| 54 | C601 | 1 | Wobbulator | 822-004 |
| 114 | FB201, 202 | 5 | Filter Barrel Assembly | 823-018 |
| 115 | FB601, 602, 603 | 5 | Filter Barrel Assembly | 823-018 |

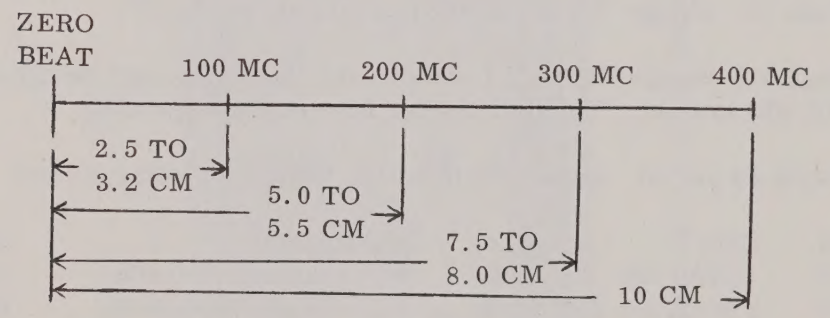
5. Page 60: change connections between T3 and pins 1 and 3 of S5 as shown below.




6. A circuit consisting of diode CR7 and resistor R44 is included in some units to set sweep linearity within 5 percent. All units have the diode connected between pin 3 of S5 and a nearby tie point. The connection between this tie point and pin 1 of S5 may be made in any one of the following manners: 1) no connection, indicating that the circuit is not active; 2) through a jumper wire; 3) through a 1-ohm resistor or; 4) through two 1-ohm resistors connected in parallel.

Replacement or aging of the wobbulator may offset linearity beyond the 5-percent limit. In this event, the diode/resistor circuit will have to be reevaluated.

a. To determine the adequacy of the linearity, proceed as follows:
   1) Switch on 900-B power and allow 30 minutes for warm-up.
   2) Switch on the 100 mc markers.
   3) Operating the 900-B in the VHF wide-sweep mode, obtain a 0 to 400 mc display on an oscilloscope. If this 400 mc bandwidth cannot be obtained, refer to step b.
   4) Using the oscilloscope controls, adjust the display so that the zero beat and the 400 mc marker mark-off a 10 cm length on the display grid. The 100, 200, and 300 mc markers should fall on this length within the limits shown below. If the markers are located outside these limits, proceed to step c.




b. In the event that the 400 mc bandwidth cannot be obtained, first check that the wobbulator is not defective and that the WOBB DRIVE LIMIT potentiometer is set properly. If these considerations do not account for the insufficient bandwidth, remove the components of the diode/resistor circuit one at a time, begining with the resistors (if they are included), until the 400 mc marker is seen; the linearity will then be adequate. For example, if the circuit has the two resistors and the diode, first remove one of the resistors. Next, bypass the remaining resistor with a piece of wire; if this widens the bandwidth sufficiently, disconnect the resistor and replace it with a jumper. If it does not, simply disconnect the resistor.

c. If the markers are located outside their limits, add components to the resistor/diode circuit, begining with the diode, until the markers are located correctly. For example, if the diode is not connected, first use a jumper to connect pin 1 of S5 to the cathode end of the diode. Next, remove the jumper and replace it with a 1-ohm, 1-watt resistor. Finally, if still more correction is needed, parallel this resistor with another of the same value and power rating.

JERROLD ELECTRONICS CORPORATION
PHILADELPHIA, PA., 19105
AKE, February 1967

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INSTRUCTION MANUALS
435-307.3 and 435-505
AMENDMENTS A2

# SWEEP SIGNAL GENERATORS
# MODELS 900-B AND 900-C

## INTRODUCTION

These amendments correct and supplement information contained in Instruction Manuals 435-307.3 and 435-505 and describe the differences between Model 900-B and Model 900-C.

## DIFFERENCES BETWEEN MODELS 900-B AND 900-C

The major difference between the two models is in the output attenuator: the 900-C uses a high-precision (±0.5 dB accuracy at 50 dB setting) rotary-type attenuator (Jerrold Model ATV-50) instead of the switchable attenuator (Jerrold Part No. 107-005) used in the 900-B. In addition, the 900-C is housed in a differently styled cabinet.

## PARTS LIST CHANGE, FOR MODEL 900-C ONLY

Page 54: change the Jerrold Part No. entry for Item 1 from "107-005" to "ATV-50".

## ADDITIONAL CHANGES, FOR BOTH MODELS

1. Page 3: add the following to par. 2-2.

   When operating the unit from a 50-cycle power line, it will be necessary to either remove R43 (Dwg. No. 861-388) or bypass it with a piece of wire in order to obtain adequate filament voltage for the oscilloscope pre-amplifier.

2. Page 35, right hand column, 5th line from bottom: change "200 ma of plate current" to read "20 mA of plate current.

JERROLD ELECTRONICS CORPORATION
PHILADELPHIA, PA. 19105
AKE, February 1967

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# SECTION 1
# Description and Specifications

### 1-1. DESCRIPTION

Model 900-B is an r-f sweep generator designed to provide an extensive range of frequencies over which the sweep measurement technique can be applied to the analysis of electronic circuits. The 900-B generates signals in the frequency range of 500 kc to 1200 mc, with sweep widths variable from 10 kc to 400 mc.

A built-in oscilloscope preamplifier, a crystal-controlled harmonic marker generator, and a precision attenuator reduce the need for separate auxiliary equipment, keeping test set-up time to a minimum.

In addition, the unit has the input and amplifying circuiting necessary for insertion of one or two externally generated marker signals.

A Jerrold Model D-50B plug-in r-f detector is provided on the front panel of the 900-B. For applications where cable lengths may become critical (measurements in the uhf range) the detector may be removed from the 900-B housing, for placement beside the circuit under test.

Model 900-B can be operated from 115- or 230-vac, 50- or 60-cycle power sources.

### 1-2. SPECIFICATIONS

The specifications of the 900-B are listed in Table 1.

### 1-3. TUBE AND TRANSISTOR COMPLEMENT

Table 2 lists the tubes and transistors employed in the instrument.

**TABLE 1. SPECIFICATIONS**

| | |
|---|---|
| FREQUENCY RANGE— VARIABLE LIMITS | VHF (both Wide and Narrow): 500 kc to 400 mc<br>UHF Narrow: 350 mc to 1200 mc<br>Wide: 275 mc to 1100 mc |
| SWEEP WIDTH | VHF Narrow: Minimum 10 kc or less<br>Maximum 1 mc or more<br>Wide: Minimum 500 kc or less<br>Maximum 400 mc or more<br>UHF Narrow: Minimum 10 kc or less<br>Maximum 1 mc or more<br>Wide: Minimum 500 kc or less<br>Maximum 40% of C.F. or more |
| OUTPUT VOLTAGE | VHF: 0.25 v rms or more into 50-ohm load<br>UHF: 0.5 v rms or more into 50-ohm load |
| OUTPUT VOLTAGE VARIATION | *VHF: ±0.5 db at maximum sweep width<br>*UHF: ±0.5 db to 800 mc and ±1.5 db from 800 to 1200 mc at maximum sweep width. Output voltage variation less at narrower sweep widths<br>*As viewed on D50B detector. |
| SPURIOUS BEATS AND HARMONICS | 20 db or more below fundamental output |
| IMPEDANCE | 50 ohms, nominal |
| DETECTOR | Full-wave, peak-to-peak feed-thru type. VSWR less than 1.3:1 up to 900 mc and less than 1.4:1 up to 1200 mc, wtih a termination whose VSWR is 1.05:1 or better. |
| FREQUENCY MODULATION | Line frequency, sinusoidial |
| HORIZONTAL DEFLECTION VOLTAGE | 20 volts peak-to-peak |
| MARKERS (INTERNAL) | Built-in crystal-controlled harmonic markers at 1, 10, and 100 mc intervals. Each marker output is individually controlled from the front panel. |
| MARKER INPUT (EXTERNAL) | Requires 20 millivolts or more. Gain of marker amplifier is variable from 0 to 100X. |
| OSCILLOSCOPE PREAMPLIFIER | Built-in preamplifier with gain variable from 2X to 200X . . . dc or ac coupling. |
| ATTENUATOR | Built-in variable attenuator 0 to 50 db in 10 db steps. |
| FREQUENCY DIAL | Calibrated in four ranges: VHF Narrow, VHF Wide, UHF Narrow, and UHF Wide. Accuracy is within one division of the indicated frequency on UHF ranges with the cursor set at center position, measured at minimum sweep width. |
| OUTPUT METER | Provides output level measurement, accurate within ± 1 db from 0-400 mc. For accuracy from 400-1200 mc see Fig. 3. |
| BLANKING | Return trace blanking optional with panel switch. Blanks to 0 voltage. |
| POWER SOURCE | 100 to 130 or 200 to 260 v ac @ 50 or 60 cps. |
| POWER CONSUMPTION | Approximately 100 watts. |

**TABLE 2. TUBE AND TRANSISTOR COMPLEMENT**

| TUBE NO. | TYPE | LOCATION | FUNCTION |
|---|---|---|---|
| V1 | 0A2 | MAIN CHASSIS | B— voltage regulator |
| V2 | 0A2 | MAIN CHASSIS | B+ voltage regulator |
| V201 | 5675 | FIXED OSCILLATOR CHASSIS | 600 mc oscillator |
| V301 | 6AU6 | ALC CHASSIS | ALC amplifier |
| V302 | 6AU6 | ALC CHASSIS | Push-pull input amplifier |
| V303 | 6CW5 | ALC CHASSIS | ALC amplifier |
| V304 | 6CW5 | ALC CHASSIS | Push-pull output amplifier |
| V305 | 6922 | ALC CHASSIS | Meter amplifier |
| V306 | 12AT7 | ALC CHASSIS | Blanking amplifier |
| V401A | ½6922 | HARMONIC MARKER CHASSIS | 5 mc crystal-controlled oscillator |
| V401B | ½6922 | HARMONIC MARKER CHASSIS | 1 mc multivibrator |
| V402 | 6CB6 | HARMONIC MARKER CHASSIS | 10 mc multiplier |
| V403A | ½6922 | HARMONIC MARKER CHASSIS | 50 mc multiplier |
| V403B | ½6922 | HARMONIC MARKER CHASSIS | 100 mc multiplier |
| V501 | 6922 | PREAMPLIFIER CHASSIS | Input amplifier |
| Q501 | 2N1748A | PREAMPLIFIER CHASSIS | Second stage amplifier |
| Q502 | 2N1748A | PREAMPLIFIER CHASSIS | (transistors) |
| V502 | 6AU6 | PREAMPLIFIER CHASSIS | Output amplifier |
| V503 | 12AY7 | PREAMPLIFIER CHASSIS | Marker amplifier |
| V601 | 5675 (modified) | SWEEP OSCILLATOR CAVITY | Sweep oscillator |

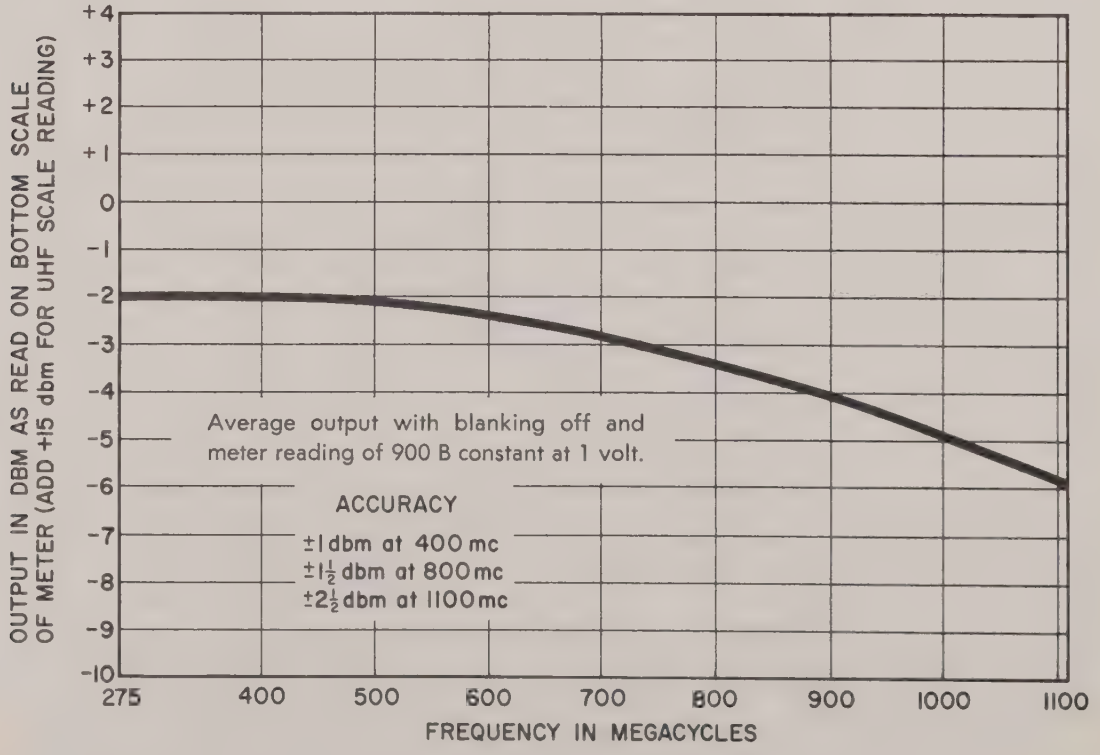



**Fig. 3—Calibration Curve**

# SECTION 2
# Preparation and Initial Check

### 2-1. GENERAL

After unpacking the 900-B, see that it has not been damaged in transit. Be certain that the three fuses are in place, that the tubes are securely seated in their sockets, and that all internal connectors are fully mated to their receptacles.

### 2-2. ADJUSTMENT FOR LINE VOLTAGE

Model 900-B is shipped with the 115V-230V switch set to 115V and the 15 prong-plug mated with the 60~ receptacle (Fig. 8). For operation at 230 volts, set the 115V-230V switch to the 230V position. If the frequency of the available power source is 50 cycles, mate the 15-prong plug with the 50~ receptacle.

### 2-3. RACK MOUNTING

Remove the eight screws (four on each side of the front panel) which hold the unit in the cabinet. Open the cover and loosen the two screws (one on each side of the rear bracket) and raise the bracket to permit removing the unit. Mounting on a standard 19-inch rack should be done so that the rear end of the 900-B is well supported.

### 2-4. ACCESSORY EQUIPMENT REQUIRED

An oscilloscope is necessary for displaying the signals generated by the 900-B. A dc-coupled oscilloscope is preferred, but an ac-coupled instrument with good squarewave response at the power line frequency may be employed for most applications. An important exception to this is that a dc-coupled oscilloscope must be used in performing the 900-B alignment procedures. Vertical sensitivity of 0.1 volt per centimenter is adequate because of the gain provided by the oscilloscope preamplifier built into the 900-B.

### 2-5. CONTROLS

The operator should become thoroughly familiar with the functions of the controls, fittings, and adjustments on the 900-B before operating it. Table 3 provides this information.

**TABLE 3. CHART OF CONTROLS**

| NAME | TYPE AND SCHEMATIC REFERENCE | POSITION | FUNCTION |
|---|---|---|---|
| | | **FRONT PANEL** | |
| METER | Voltmeter M301 | Top Scale | Indicates output voltage for UHF ranges (see Fig. 3 for limits). Calibrated from 0.5 to 2 volts in 0.5 volt steps. |
| | | Middle Scale | Indicates output voltage for VHF ranges. Calibrated from 0 to 0.35 volts to 0.1 volt steps. |
| | | Bottom Scale | Calibrated from —10 to +4 dbm in 1 dbm steps. It is read directly for VHF. Add 15 dbm for UHF. |
| FREQUENCY MEGACYCLES | Knob and calibrated dial | | Defines center frequency. Scale in use indicated by illuminated arrows. |
| | | Top Scale (UHF narrow) | Calibrated from 350 to 1200 mc in 10 mc steps. |
| | | 2nd Scale (UHF wide) | Calibrated from 275 to 1100 mc in 10 mc steps. |
| | | 3rd Scale (VHF wide) | Calibrated from 0 to 460 mc in 10 mc steps. |
| | | Bottom Scale (VHF narrow) | Calibrated from 0 to 450 mc in 10 mc steps. |
| SWEEP WIDTH (WIDE-NARROW) | 2-position switch SW3 | WIDE | Provides sweep widths of from 500 kc to 400 mc. |
| | | NARROW | Provides sweep widths of from 10 kc to 1 mc. |
| BAND SELECTOR | 2-position switch SW5 | VHF | Selects VHF range of center frequencies. |
| | | UHF | Selects UHF range of center frequencies. |
| ATTENUATOR | 6-positon rf attenuator | 0 | Output is not attenuated |
| | | 10 | Output is attenuated by 10 db. |
| | | 20 | Output is attenuated by 20 db. |
| | | 30 | Output is attenuated by 30 db. |
| | | 40 | Output is attenuated by 40 db. |
| | | 50 | Output is attenuated by 50 db. |
| PULL TURN FOR ZERO | Potentiometer and push-pull switch R28/SW11 | "in" | Normal position (UHF oscillator energized). |
| | | "out" | De-energizes UHF oscillator. Control is adjusted to zero output meter. Note: Switch blanking "off" when measuring output voltage: the meter will read low with blanking "on". |

**TABLE 3. CHART OF CONTROLS**—(Continued)

| NAME | TYPE AND SCHEMATIC REFERENCE | POSITION | FUNCTION |
|---|---|---|---|
| POWER | Toggle Switch SW1 | ON<br>OFF | Energizes 900-B.<br>De-energizes 900-B. |
| FINE TUNING | Potentiometer R14 | cw<br>ccw | Fine frequency tuning adjustment. |
| RF OUTPUT | Potentiometer R10 | cw<br>ccw | Maximum rf output.<br>Minimum rf output. |
| SWEEP WIDTH | Potentiometer R9 | <br><br>cw<br>ccw | Controls sweep width within range determined by the BAND SELECTOR and SWEEP WIDTH switches.<br>Maximum sweep width.<br>Minimum sweep width. |
| PHASING TURN BLANKING PULL | Potentiometer and push-pull switch R8/SW10 | "in"<br><br><br>"out" | No blanking on reverse trace. Potentiometer is adjusted so that forward and reverse traces on display coincide.<br>Blanks return trace. |
| MARKER GAIN<br>1 MC | Potentiometer and push-pull switch R21/SW6 | <br>"in"<br>"out"<br>cw<br>ccw | <br>Disables 1 mc marker generator.<br>Energizes 1 mc marker generator.<br>Maximum amplitude of 1 mc markers.<br>Minimum amplitude of 1 mc markers. |
| 10 MC | Potentiometer and push-pull switch R22/SW7 | "in"<br>"out"<br>cw<br>ccw | Disables 10 mc marker generator.<br>Energizes 10 mc marker generator.<br>Maximum amplitude of 10 mc markers.<br>Minimum amplitude of 10 mc markers. |
| 100 MC | Potentiometer and push-pull switch R23/SW8 | "in"<br>"out"<br>cw<br>ccw | Disables 100 mc marker generator.<br>Eneregizes 100 mc marker generator.<br>Maximum amplitude of 100 mc markers.<br>Minimum amplitude of 100 mc markers. |
| MASTER GAIN | Potentiometer and push-pull switch R24/SW9 | "in"<br><br>cw<br>ccw<br>"out"<br><br><br>cw<br>ccw | Controls amplitude of all internal markers simultaneously.<br>Maximum internal marker amplitude.<br>Minimum internal marker amplitude.<br>Connects external markers into 900-B. Controls amplitude of all markers (internal and external) simultaneously.<br>Maximum marker amplitude.<br>Minimum marker amplitude. |
| FIXED OSCILLATOR FREQUENCY | Trimmer C205 | ——— | Fine adjustment to set VHF oscillator frequency at 600 mc so that 900-B harmonic markers are accurate. |
| PREAMPLIFIER BAL | Dual Potentiometer R527 | ——— | Adjusted so that the dc reference level of the preamplifier output is unaffected by the setting of the GAIN control in this group. The rear section (a screw driver adjustment) provides a coarse adjustment, while the forward section (a front panel knob adjustment) provides fine adjustment. |
| GAIN | Potentiometer R506 | ——— | Controls gain of preamplifier. |
| DC LEVEL | Potentiometer R37 | ——— | Sets dc reference level of preamplifier output. |
| AC-DC | Toggle switch SW12 | AC<br>DC | Ac-couples preamplifier output.<br>Dc-couples preamplifier output. |
| RF OUTPUT | BNC fitting J4 | ——— | R-f output connector. |
| **REAR APRON OF MAIN CHASSIS** | | | |
| SCOPE HORIZ | BNC fitting J1 | ——— | Oscilloscope horizontal drive output connector. |

**TABLE 3. CHART OF CONTROLS**—(Continued)

| NAME | TYPE AND SCHEMATIC REFERENCE | POSITION | FUNCTION |
|---|---|---|---|
| BLK PHASE | Potentiometer R29 | ——— | Adjusts phase of blanking pulse so that blanking occurs in phase with sweep. |
| PHASE REVERSE | Toggle switch SW4 | NORMAL<br>PHASE REV | Oscilloscope trace moves from left to right.<br>Oscilloscope trace moves from right to left.<br>Note: To obtain left to right oscilloscope trace when using a Jerrold Model SD-8A slow-speed sweep driver unit, the PHASE REVERSE switch must be set to the position which gives right to left trace with internal drive. |
| EXTERNAL MARKERS | BNC fittings J2 and J3 | ——— | External marker input connectors. |
| EXT WOBB | 6-prong socket S5 | ——— | Connects external drive voltage to wobbulator. Plug P5 is inserted if internal drive is to be used. |
| 2 AMP FUSE | Fuse FS1 | ——— | Protects 900-B. |
| **TOP OF MAIN CHASSIS** | | | |
| VHF-AGC DET | 4-prong socket S-302 | ——— | Connects VHF-AGC detector to ALC circuit. |
| SWEEP OSC | 6-prong plug P15 | ——— | Connects power to sweep oscillator head. |
| HARMONIC MARKER | 4-prong plug P401 | ——— | Connects power to harmonic marker chassis. |
| WOBB DRIVE LIMIT | Potentiometer R6 | ——— | Protects wobbulator unit by limiting voltage applied to it. |
| B+ .1 AMP | Slo-blo fuse FS2 | ——— | Protects B+ supply. |
| B— .1 AMP | Slo-blo fuse FS3 | ——— | Protects B— supply. |
| **BOTTOM OF MAIN CHASSIS** | | | |
| 230V-115V | Toggle switch | 230 V<br>115 V | Connects power transformer primary windings for 230 V operation.<br>Connects power transformer primary windings for 115 V operation. |
| 50~ | Socket S1 | ——— | Connects power transformer primary and secondary windings for 50-cycle operation. |
| 60~ | Socket S2 | ——— | Connects power transformer primary and secondary windings for 60-cycle operation. |
| CATHODE TUNING | Trimmer C201 | ——— | Tune VHF fixed oscillator. |
| PLATE TUNING | Trimmer C206 | ——— | |
| **PREAMPLIFIER CHASSIS** | | | |
| POL | Toggle switch SW501 | +<br>— | Determines phase of output signal from oscilloscope preamplifier. |
| SCOPE VERT | BNC fitting J501 | ——— | Oscilloscope vertical drive output connector. |
| EXT DET | Phone jack J502 | ——— | Permits the addition of markers to an externally detected signal and the amplification of the combined signal. |

**TABLE 3. CHART OF CONTROLS**—(Continued)

| NAME | TYPE AND SCHEMATIC REFERENCE | POSITION | FUNCTION |
|---|---|---|---|
| | | ALC CHASSIS | |
| VHF METER CALIBRATE | Potentiometer R304 | ——— | Adjusted to calibrate meter for VHF operation. |
| UHF METER CALIBRATE | Potentiometer R333 | ——— | Adjusted to calibrate meter for UHF operation. |
| ALC GAIN | Potentiometer R319 | ——— | Adjusts gain of ALC amplifier. |
| ALC BIAS | Potentiometer R314 | ——— | Adjusted to operate ALC amplifier linearly. |

## 2-6. INITIAL CHECK

1. Connect the SCOPE HORIZ fitting on the rear apron of the 900-B chassis to the horizontal input of a dc-coupled oscilloscope.
2. Set the 900-B PREAMPLIFIER AC-DC switch to DC.
3. Set the 900-B PREAMPLIFIER BAL control (front panel) to mid-range.
4. Set the 900-B PREAMPLIFIER GAIN control fully counter-clockwise (minimum gain).
5. Set the BAND SELECTOR switch to UHF.
6. Set the SWEEP WIDTH to WIDE.
7. Set the SWEEP WIDTH control fully clockwise (maximum sweep width).
8. Set the RF OUTPUT control fully clockwise (maximum output).
9. Set the ATTENUATOR switch to 20.
10. Insert shorting plug P5 into the EXT WOBB DRIVE socket.
11. Plug the 900-B power cord into an appropriate power outlet.
12. Set the POWER SWITCH to ON and allow 30 minutes for warm-up.

**Notes**

a. It is important that no evaluation of sweep width be made prior to the 30-minute warm-up period, because in the cold state the wobbulator diaphragm is too stiff to make its maximum excursion.

b. If the wobbulator chatters at any time, turn the WOBB DRIVE LIMIT control, on the main chassis, counter-clockwise until the noise stops. Chattering does not indicate any malfunction of the 900-B; no harm will result unless the chattering is permitted to continue for pro-longed periods.

13. Set the oscilloscope vertical sensitivity to 0.1 volt per centimeter and set the horizontal sensitivity to 2 volts/cm. Center the trace on the screen.
14. Connect the SCOPE VERT fitting on the rear of the 900-B preamplifier chassis to the dc-coupled vertical input of the oscilloscope. If the trace disappears, return it to the reference line established in step 13 by adjusting the PREAMPLIFIER DC LEVEL control.
15. Turn the GAIN control fully clockwise. If the trace moves, return it to the reference line by adjusting the "coarse" PREAMPLIFIER BAL control, a screwdriver adjustment accessible through the center of the BAL control knob.
16. Return the GAIN control to the full counterclockwise position. If the trace moves, return it to the reference by adjusting the DC LEVEL control.
17. Repeat steps 15 and 16 until the GAIN control can be rotated throughout its entire range without changing the position of the trace by more than 2 cm. The front panel ("fine") BAL control may be used for finer adjustment.
18. Remove connection to the oscilloscope vertical input. If the trace moves, adjust the DC LEVEL control until the trace remains in position whether or not the vertical input connection is made.
19. Reconnect the oscilloscope vertical input.
20. Pull the BLANKING switch.
21. Connect the RF OUTPUT fitting to one input of the D-50B detector; use a short piece of high-quality, 50-ohm coaxial cable (RG-55/U, or equivalent). Terminate the unused input connector on the detector with the TR-53 termination supplied with the 900-B.
22. Pull the 100 MC marker switch.
23. Set marker MASTER GAIN control for maximum gain (fully clockwise).
24. Turn the 100MC marker control clockwise until markers appear.
25. Push the BLANKING switch and observe the forward and return traces, each with a set of markers. Adjust the PHASING control so that the traces and markers approach coincidence.
26. Pull the BLANKING switch.
27. Adjust the RF OUTPUT control to flatten the oscilloscope trace.

**Note**

Response should be within $\pm 0.5$ db from 0.5 to 800 mc and within $\pm 1.5$ db from 800 to 1000 mc. To check this,

insert a high quality 1 db pad between the 900-B sweep output and the D-50B detector and note how far the trace falls. This establishes a 1 db reference against which the response can be measured. Remove the pad after making the response check.

28. Using the 1, 10, and 100 mc markers, check the range of the SWEEP WIDTH control. It should be at least from 500 kc to 40% of center frequency. (Section 3 explains the proper use of markers.)

**Notes**

a. Phasing must be readjusted (steps 24, 25 and 26) whenever the SWEEP WIDTH control setting is changed.
b. If the specified maximum sweep width is not obtained, adjust the WOBB DRIVE LIMIT potentiometer in a clockwise direction until it is.

c. If the 1 mc markers are not visible or if they are off frequency, adjust the 1 MC potentiometer, on the harmonic marker chassis, so that nine 1 mc markers appear between any pair of 10 mc markers.

29. Set the SWEEP WIDTH switch to NARROW and check the range of the SWEEP WIDTH control using the 1 mc marker. The range should be at least from 10 kc to 1 mc.
30. Set the BAND SELECTOR switch to VHF.
31. Set the ATTENUATOR switch to 0.
32. Set the SWEEP WIDTH control for maximum sweep width and adjust phasing.
33. Set the RF OUTPUT control fully clockwise; then slowly turn it counterclockwise until the response trace flattens.
34. Check the range of the SWEEP WIDTH control. It should be at least from 10 kc to 1 mc.
35. Pull the 100 MC marker switch.
36. Tune the 900-B to 0 mc.
37. Adjust the FIXED OSCILLATOR FREQUENCY control so that the 100 mc marker is just off the center of the zero beat.

**Note**

This tunes the fixed oscillator just off 600 mc. If this oscillator is tuned to precisely 600 mc, its signal will mix with the 6th harmonic of the 100 mc marker to generate an audio beat signal which will distort the trace display.

38. Set the SWEEP WIDTH switch to WIDE.
39. Adjust the SWEEP WIDTH control for maximum sweep width.
40. Tune the 900-B to position the zero beat at the extreme left of the display.
41. Set the RF OUTPUT control fully clockwise; then slowly turn it counterclockwise until the trace flattens.
42. Using the 100 mc markers, verify that the sweep width is at least 400 mc.

**Note**

If the specified maximum sweep width is not obtained, adjust the WOBB DRIVE LIMIT potentiometer in a clockwise direction until it is.

**Fig. 4—Model 900-B, Front View**

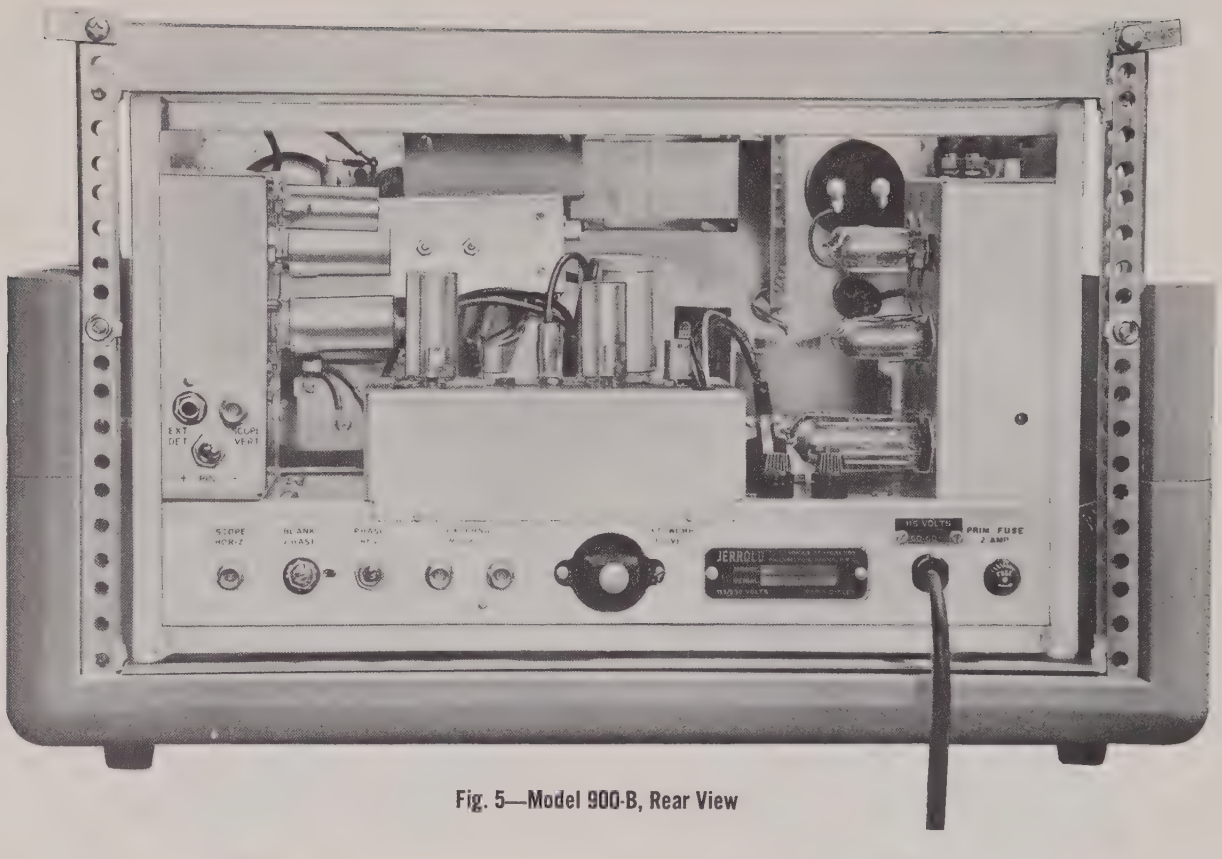



Fig. 5—Model 900-B, Rear View

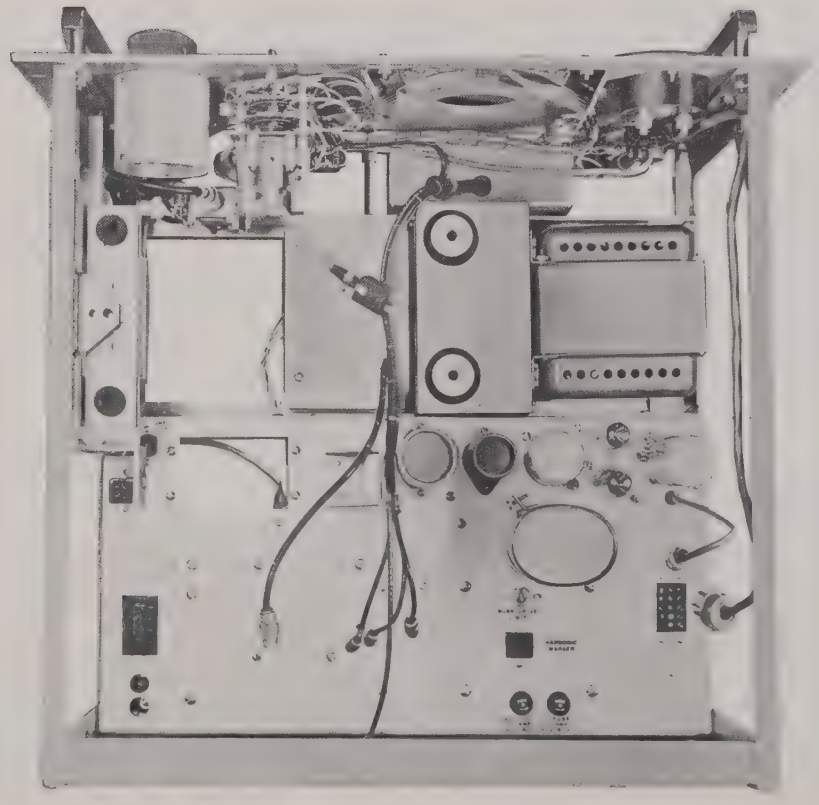


Fig. 6—Model 900-B, Top View with Modules Removed

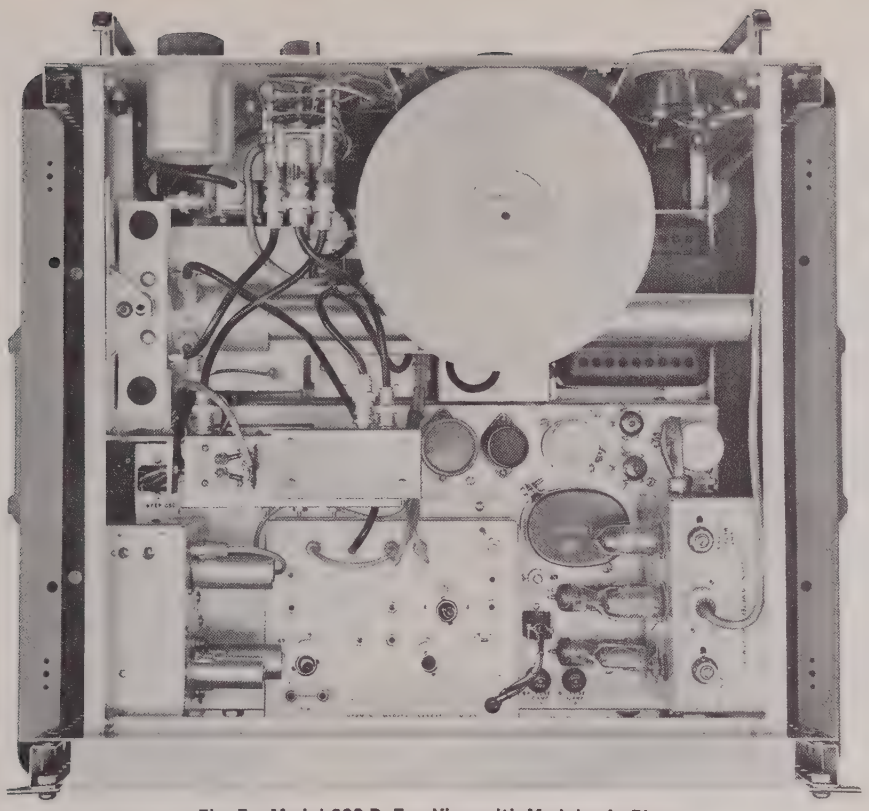


Fig. 7—Model 900-B, Top View with Modules in Place

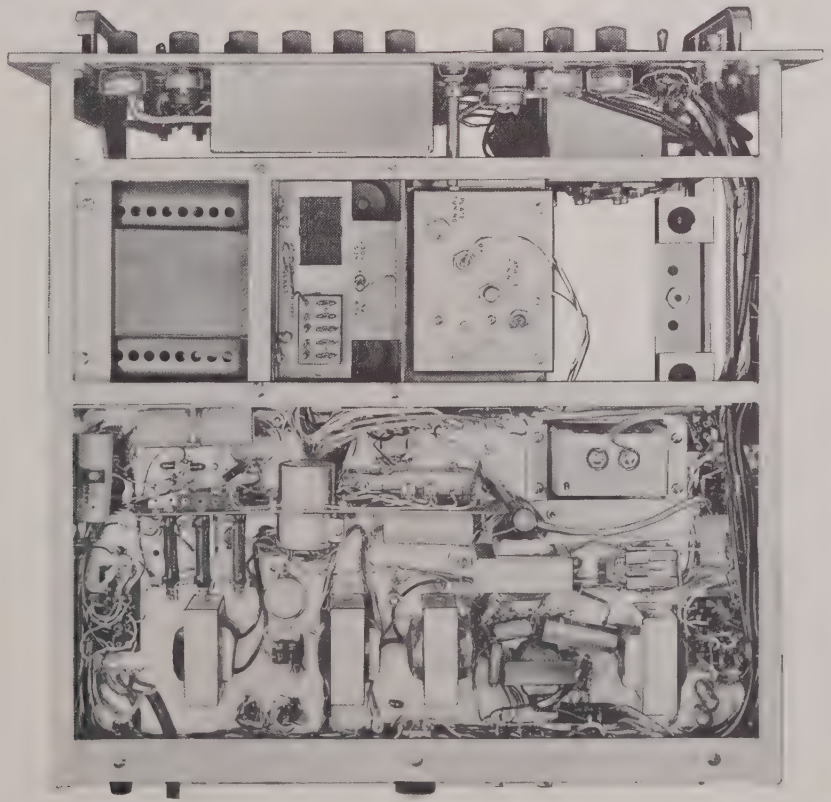


Fig. 8—Model 900-B, Bottom View

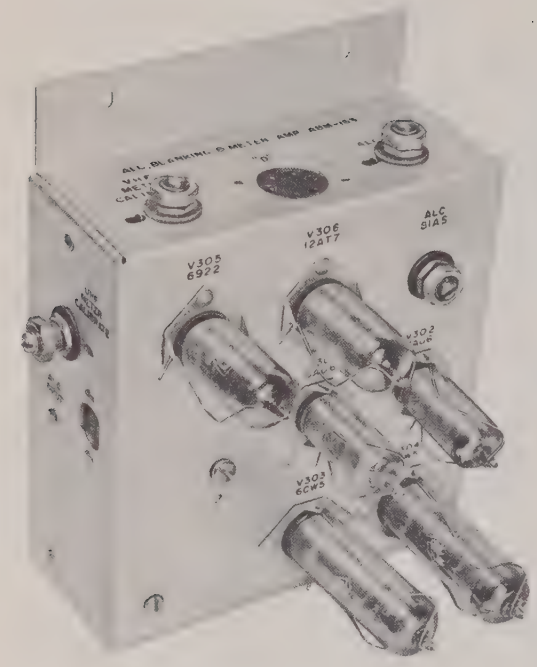



Fig. 9—ALC Module, Oblique View

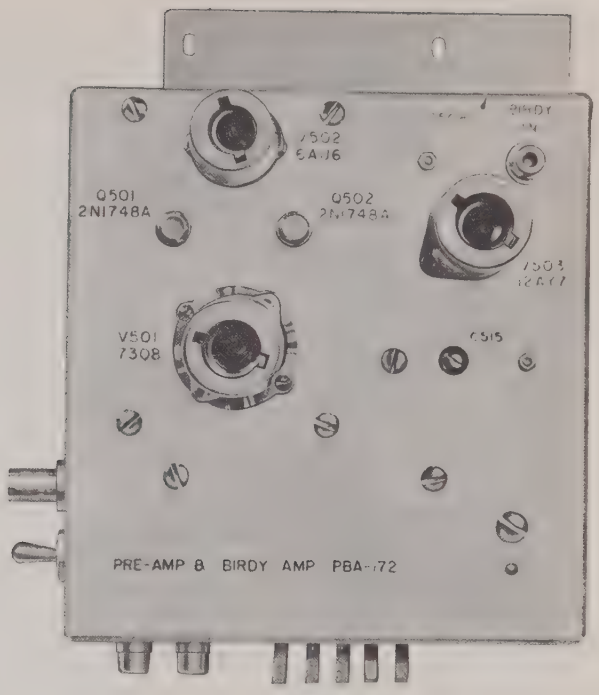



Fig. 11—Preamplifier Module, Top View

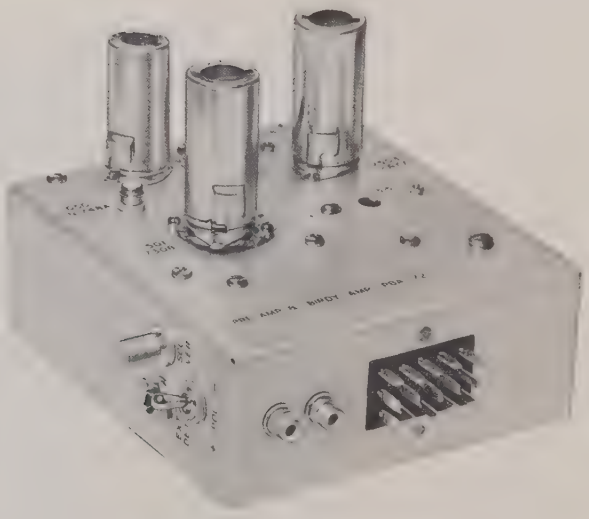


Fig. 12—Preamplifier, Oblique View

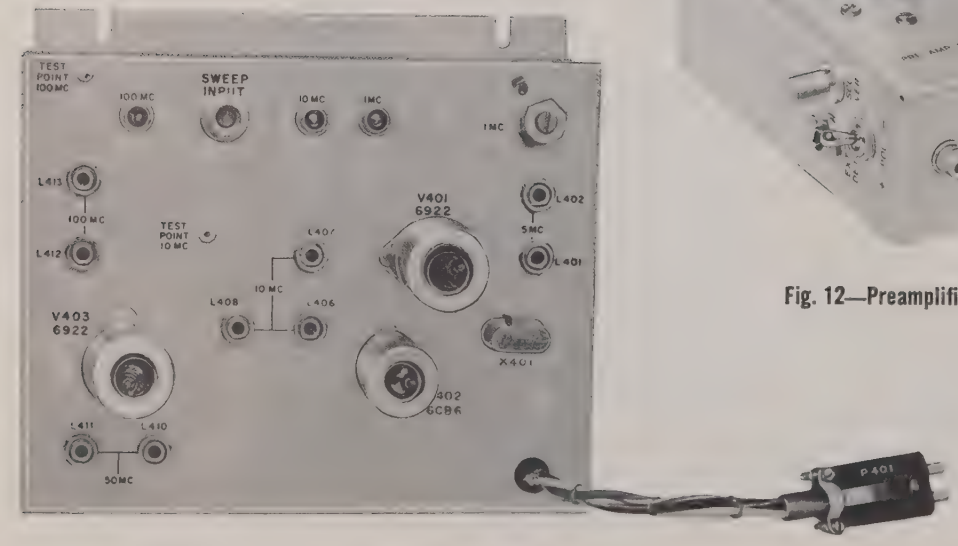



Fig. 10—Harmonic Marker Module, Top View

# SECTION 3
# Markers

### 3-1. INTERNAL MARKERS

The 900-B provides markers at 1, 10, and 100 mc and at all multiples of these frequencies within the range of the unit. Separate amplitude controls are provided for the three groups of markers to allow quick identification of the frequency represented by a marker.

### 3-2. The Use of Internal Markers

To obtain the response display indicated in Fig. 13, the r-f output of the 900-B was fed through a resonant circuit to the D-50B detector, and the SCOPE VERT and SCOPE HORIZ output terminals of the 900-B were connected to the oscilloscope. The 900-B was set for wide sweep with a center frequency of 750 mc. All marker controls were "off".

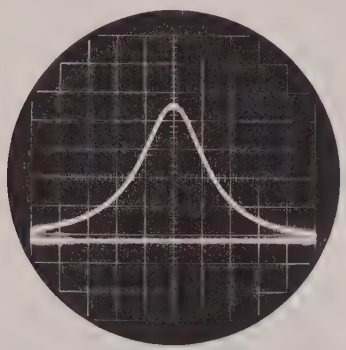


**Fig. 13—Response Display of a Resonant Circuit**

To obtain 100 mc marks (Fig. 14) the sweep width was increased, and the 100 MC marker control was pulled and adjusted to make the markers visible. Since the 900-B was tuned to 750 mc, the markers appeared at 700 and 800 mc.

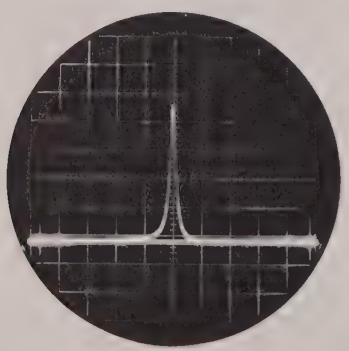


**Fig. 14—100 mc Markers on Response Display**

To obtain 10 mc marks (Fig. 15), the 10 MC marker switch was pulled and the marker amplitude was set somewhat lower than that of the 100 mc markers. The maximum response lies between the 4th and 5th marker, counting from the 700 mc marker; i.e., it lies between 740 and 750 mc.

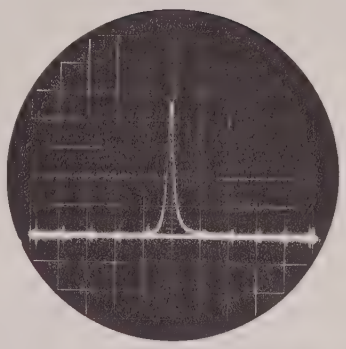


**Fig. 15—10 mc Markers on Response Display**

To obtain 1 mc marks (Fig. 16), the sweep width was narrowed and the 900-B was tuned to place the 740 and 750 mc markers at the edges of the screen. The 1 mc marker switch was turned on and adjusted so that the amplitude of the markers was lower than that of the marker at 740 mc. Counting from the 740 mc marker shows that the circuit is peaked between the 7th and 8th marker, or between 747 and 748 mc.

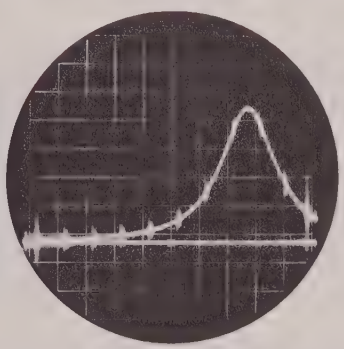


**Fig. 16— 1 mc Markers on Response Display**

If further division is required, the sweep width and 900-B tuning can be adjusted to place the 747 and 748 mc markers at the screen edges (Fig. 17). Now the 0.1 mc points can be estimated from the grid on the oscilloscope screen.

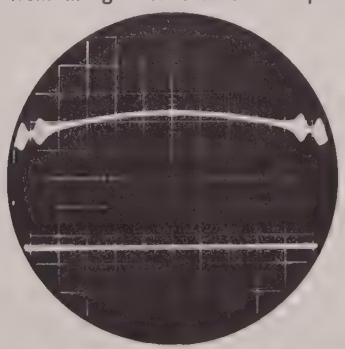


**Fig. 17—Estimating 0.1 mc Points on Response Display**

### 3-3. EXTERNAL AND SIDEBAND MARKERS

When markers from an external marker oscillator are to be employed, the marker generator output is applied to one of the INTERNAL MARKER connectors on the 900-B and the MASTER GAIN control is switched "on". The marker amplitude as displayed on the oscilloscope is affected by both the marker generator output level and the setting of the MASTER GAIN control.

### 3-4. Obtaining Best Markers at Fundamental Frequency of Marker Oscillator

Using a low level output from the marker generator provides a good marker at the fundamental frequency and minimizes markers at harmonic frequencies. With this in mind, the generator output level should be set low, and the MARKER GAIN control should be set high enough to make the marker clearly visible, but not so high as to distort the presentation. The proper display of a single marker is shown in Fig. 18.

### 3-5. Obtaining Best Markers at Harmonics of Fundamental Frequency

To obtain maximum harmonic generation in the marker mixer, it is necessary to use a high-level signal from the marker generator; the 900-B MARKER GAIN control should be adjusted for the lowest gain consistent with adequate marker display. The proper display of a marker and its harmonic markers is shown in Fig. 19.

### 3-6. Side-Band Markers

When investigating the passband of a device, it is often desirable to introduce markers at the center frequency and at the lower and upper frequency limits. This can be accomplished by using two external marker generators connected to the 900-B. One of the generators is tuned to the center frequency, the second is tuned to a frequency one half of that of the observed bandwidth. To provide proper display, the center-frequency marker signal must be higher in amplitude than the side-band marker signal.

Then the MASTER GAIN control on the 900-B is pulled and adjusted along with the output level controls on the external marker generators to produce the desired marker signals on the oscilloscope.

Fig. 20 shows a single marker at the center of the detected sweep output; in this case 60 mc.

Fig. 21 illustrates the effect of connecting the second marker generator, tuned to 1.5 mc. The 1.5 mc signal mixes with the 60 mc signal, producing sideband markers at 1.5 mc above and below 60 mc.

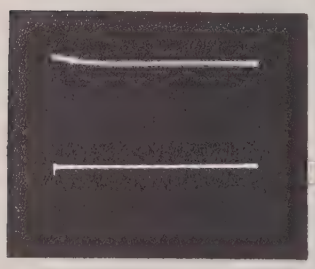


Fig. 18—Display of Single Marker at 50 mc

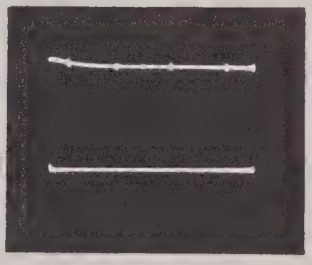


Fig. 19—Display of Markers at 50 mc Harmonics

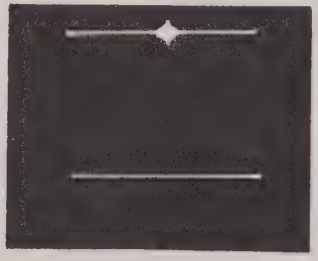


Fig. 20—Display of Marker Near Center Frequency

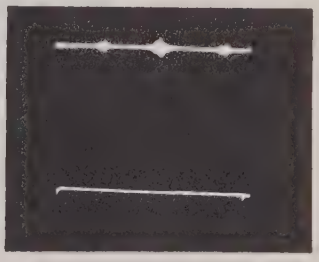


Fig. 21—Display of Sidebank Markers at Extremes of Sweep

# SECTION 4
# Applications

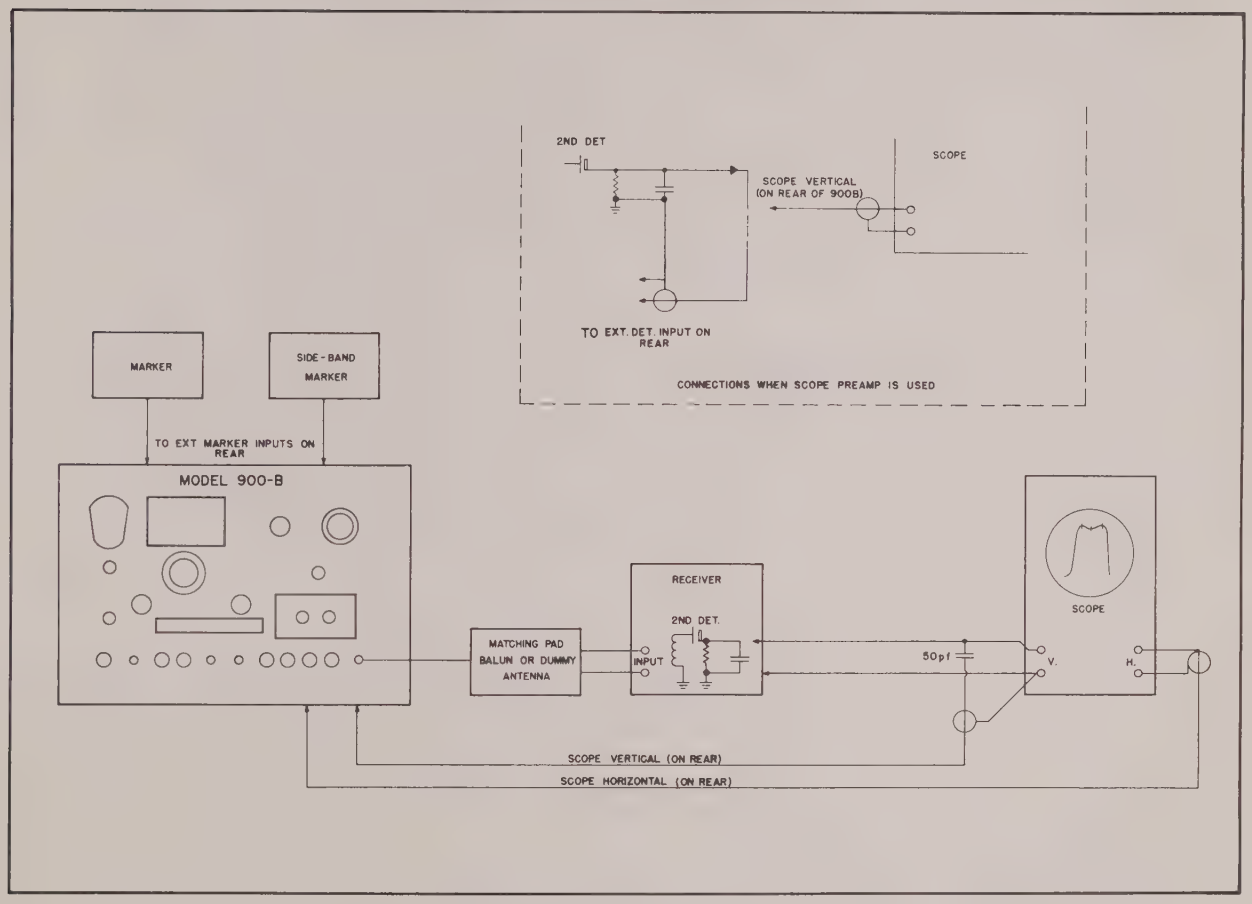



**Fig. 22—Setup for Determining the Pass Band of a Receiver**

## 4-1. DETERMINING THE PASS BAND OF A RECEIVER

(See Fig. 22)

1. Connect the sweep output of the 900-B through an appropriate dummy antenna, matching pad, or balun, as required, to the receiver input. Where the range of the attenuator built into the sweep generator is insufficient, an external attenuator can be added.

   Where the signal level at the receiver second detector is greater than 0.1 volt p-p, the 900-B oscilloscope preamplifier is not needed and the detected signal should be connected directly to the vertical input of the oscilloscope. In this case, markers can be introduced into the display by coupling the SCOPE VERT terminal on the 900-B to the oscilloscope vertical input through a low-value capacitor as shown in Fig. 22.

2. If the receiver has an AGC (automatic gain control) circuit, disable it and substitute a manual bias control.

3. Adjust the RF OUTPUT control for a low-level signal to avoid overloading the receiver. To check for overload, increase the ATTENUATOR setting by 10 db. If the shape of the displayed curve changes radically, overload is present and the sweep signal level should be reduced further.

4. Tune the 900-B and the receiver to the same frequency and set the sweep width just wide enough to show the full response curve.

5. Using the sideband marker technique (paragraph 3-6) determine the width of the response curve between the 3-db down points.

6. Where there are sudden changes in the displayed response of the receiver (e.g., when highly selective traps are included in the receiver design) it may be that the signal frequency sweeps past these points too quickly for the second detector to follow. For such situations, narrow the sweep width and tune the 900-B to cover these areas only.

7. Spurious components in the output of the 900-B may distort the response curve when rejection notches or other band elimination characteristics are displayed. Such a condition is indicated when the shape of the response curve changes as the 900-B signal output level is reduced. To avoid this condition, operate the 900-B at low output levels.

## 4-2. DETERMINING THE PASS BAND OF THE R-F STAGE OF A RECEIVER

1. Connect the sweep output of the 900-B to the receiver as described in paragraph 4-1, step 1.

2. Connect the 900-B SCOPE VERT and SCOPE HORIZ terminals to the oscilloscope input terminals.

3. Feed the signal across the dc load of the mixer to the EXT. DET. jack on the 900-B, using shielded cable to minimize hum (Fig. 23).

4. Adjust the RF OUTPUT control for a high-level output and set the ATTENUATOR to 10.

5. Using the sideband marker technique (paragraph 3-6), determine the width of the response curve between the 3-db down points.

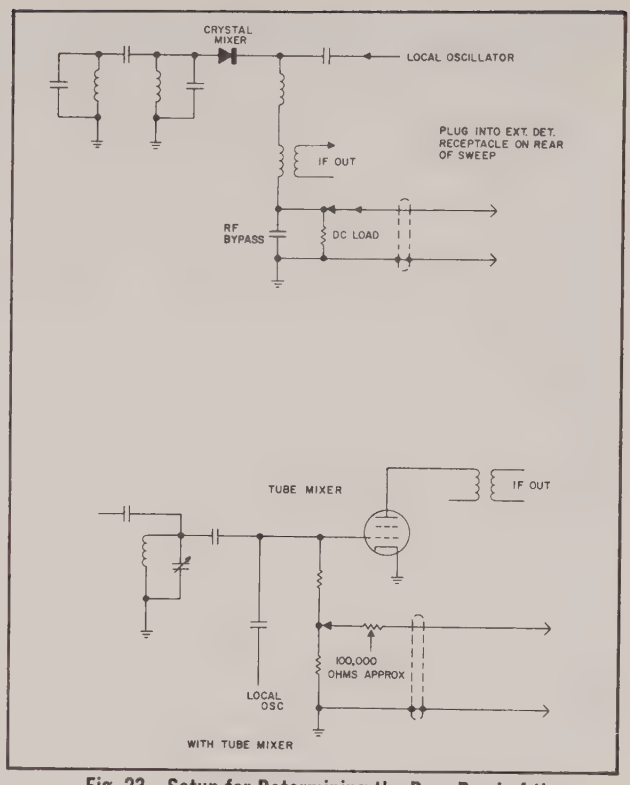



**Fig. 23—Setup for Determining the Pass Band of the R-F Section of a Receiver**

## 4-3. DETERMINING THE PASS BAND OF THE I-F STAGE OF A RECEIVER

1. Connect the 900-B sweep output to the receiver mixer as shown in Fig. 24. The sweep output cable is terminated, and the sweep signal is coupled to the mixer output circuit loosely enough to avoid detuning the circuit. The rest of the test set-up is the same as that shown in Fig. 22.

2. It is essential to couple the sweep signal in such a manner that the overall feedback in the i-f circuits is not increased. This effect is indicated when the shape of the i-f response curve differs greatly from that of the over-all receiver response curve. To avoid this condition, carefully ground the shield of the sweep signal cable to the receiver chassis at a point near the mixer circuit. Furthermore, with intermediate frequencies above 10 mc, it is best to bring the signal cable to the mixer through the receiver chassis.

3. Using the sideband marker technique (paragraph 3-6), determine the width of the response curve between the 3-db down points.

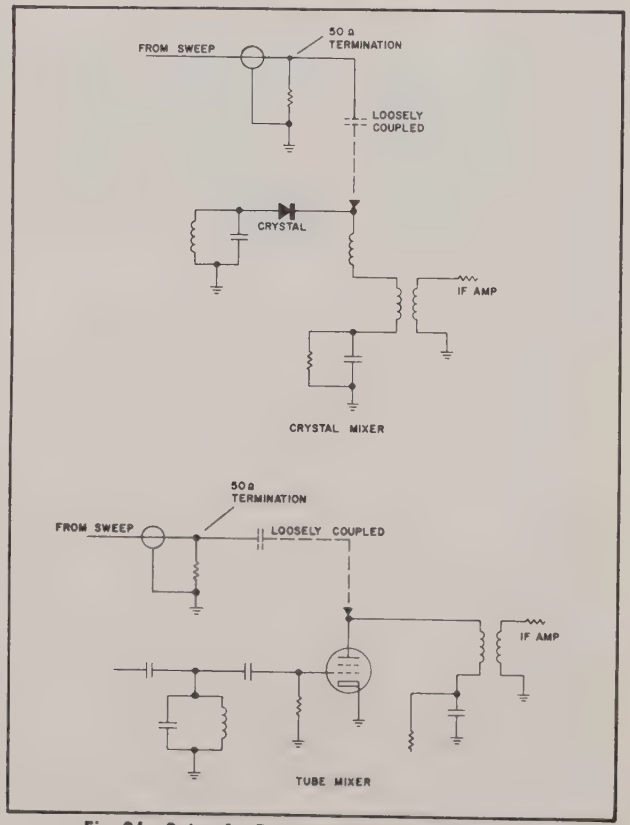



**Fig. 24—Setup for Determining the Pass Band of the I-F Section of a Receiver**

## 4-4. DETERMINING AMPLIFIER FREQUENCY RESPONSE AND GAIN

1. Connect equipment as shown in Fig. 25. The matching pads are necessary only if the terminal impedance of the amplifier differs from that of the 900-B.
2. Adjust the RF OUTPUT control for a low-level output, to avoid overloading the amplifier; set the 900-B PREAMPLIFIER GAIN control just off the point where noise distorts the oscilloscope display.
3. Disconnect the amplifier and connect the 900-B output terminal directly to the D-50B detector (through the matching pads if they are included in the test set-up).
4. With blanking "on" (BLANKING switch pulled), adjust the reference attenuator so that the distance between the reference trace and the other (full-output) trace on the oscilloscope can be measured conveniently. This is the distance H2 in Fig. 25.
5. Reconnect the amplifier and adjust the reference attenuator so that the peak of the amplifier response trace is at the same distance above the reference trace as the full output trace was in step 4 (H1 = H2 in Fig. 25). The amount of attenuation added to achieve this is a direct measure of the amplifier's maximum gain.
6. The introduction of marker signals will permit gain measurements at specific frequencies. For these tests, the distance between the reference line and the point on the response curve representing the frequency of interest is measured in step 5.
7. Gain measurements can be made more quickly and accurately by employing a high-speed voltage comparator, such as the Jerrold Model FD-30 or TC-3. Equipment is connected as shown in Fig. 26. The comparator switches alternately connect the reference attenuator and the amplifier between the sweep output and the D-50B detector. The switching occurs at such a rate that the reference and response traces appear apparently simultaneously on the oscilloscope display. The gain at any point where the response trace intersects the reference trace is equal to the difference between the settings of the reference attenuator and the attenuator connected to the amplifier input.

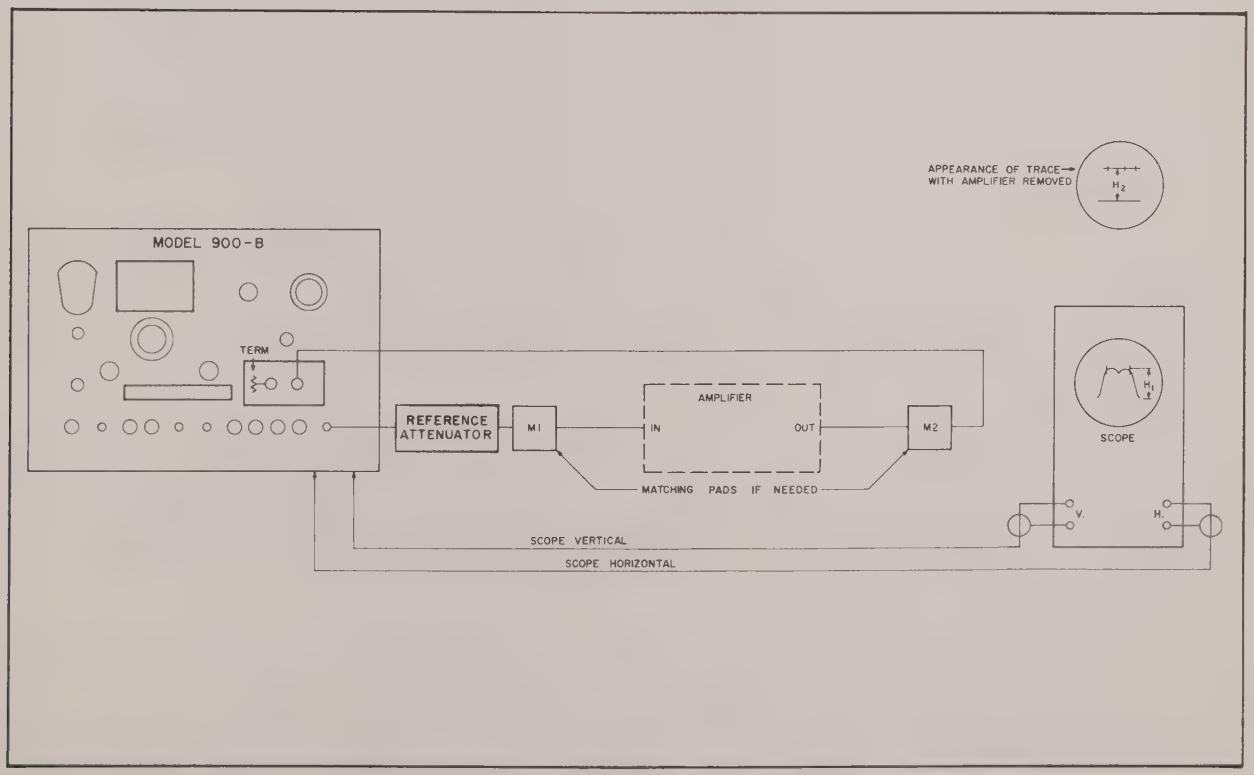



**Fig. 25—Setup for Determining Amplifier Frequency Response and Gain**

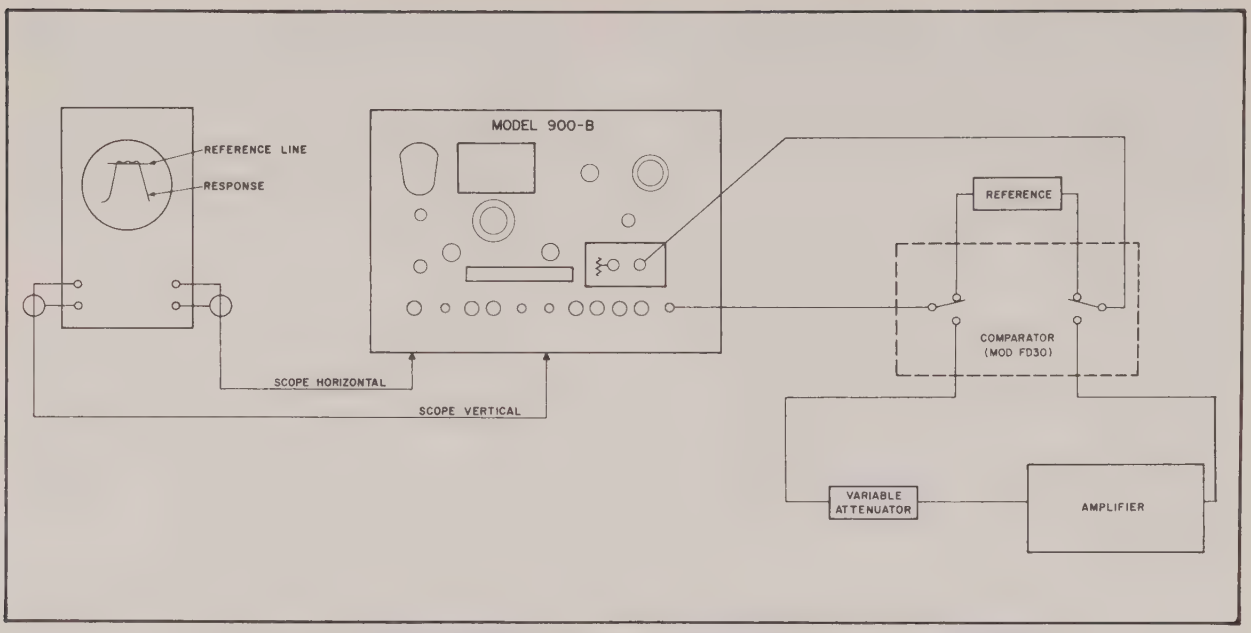



**Fig. 26—Setup for Determining Amplifier Frequency Response and Gain with a Coaxial Compartor**

## 4-5. TESTING A SINGLE STAGE OF AN AMPLIFIER

In development and maintenance work it is often necessary to determine the frequency response of a single amplifier stage. In order to obtain accurate data, this test must be accomplished in a manner that will not affect the response of the stage. The following paragraphs describe methods for connecting the stage under test into the test set-up; otherwise the test procedure is as described in paragraph 4-4.

### 4-6. Method 1

Fig. 27 illustrates a test set-up that gives good sensitivity and requires no auxiliary amplifier. The sweep signal is connected through a minimum length of cable to the grid of the tube preceding the stage under test. Six to ten db of attenuation in the sweep signal path will, in general, improve the accuracy of the response display.

The D-50B detector on the 900-B is connected to the plate of the amplifier stage under test through a network consisting of a 10 pf capacitor and a 1000 ohm resistor. For critical work, the effects of the coupling and by-pass capacitors in the amplifier circuit and the test connections can be determined by moving the detector connection to the plate of the first tube and observing any changes in the response display.

It should be noted that when this method is employed the observed response does not include the effects of feedback in the amplifier stage under test. Method 2 should be employed where these effects are important.

### 4-7. Method 2

Method 2 employs an auxiliary amplifier whose response must be flat over a frequency range greater than that of the stage under test (Fig. 28). The value of the coupling capacitors C1 and C2 must be low enough to have negligible loading effect at the test points and yet high enough to pass sufficient signal voltage at the test frequencies. A capacitor with a value of about 0.1 pf can be made by tying a square knot at the centers of two pieces of No. 30 wire with low-loss insulation, such as Teflon. The wire ends are then used to make the test connections.

**Note**

Any method of capacitive coupling can be employed for testing narrow-band (not more than 10% of center frequency) amplifiers. Test coupling capacitors as described above are recommended for testing wide-band amplifiers, since any appreciable change in coupling with frequency will introduce a deceptive tilt in the response.

If shorting the grid of the first tube to ground, through a low value capacitor, changes the indicated response, the test stage is applying feedback to preceding stages of the amplifier. If a change in the response results when the plate of the second tube is shorted to ground, through a low-value capacitor, feedback from subsequent stages is present.

## 4-8. TESTING INPUT AND OUTPUT CIRCUITS

A high impedance probe can be used in a comparator set-up to obtain accurate measurements of the gain of input and output circuits.

1. Connect equipment as shown in Fig. 29.
2. Adjust the variable attenuator to place the reference trace on the oscilloscope at the same level as the peak of the circuit response trace. Note the attenuator setting.

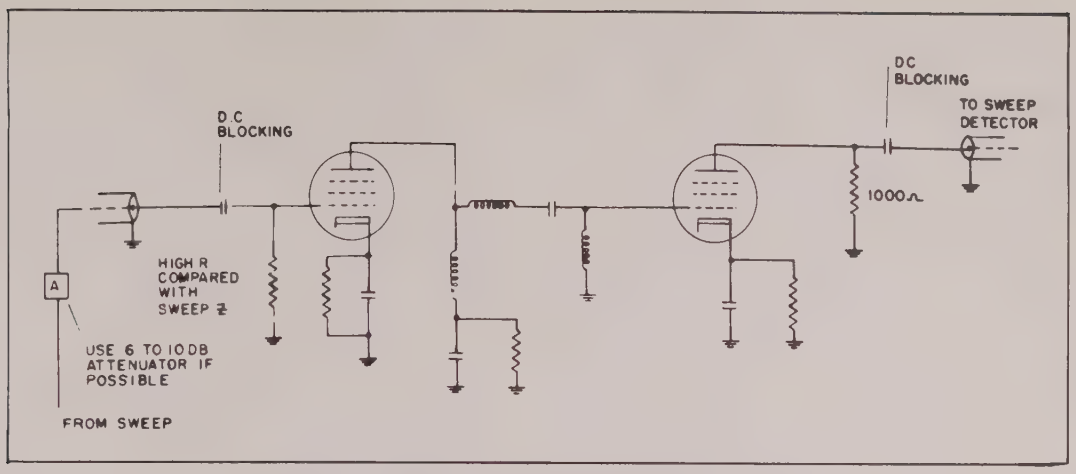



Fig. 27—Setup for Testing an Amplifier Stage, Method 1

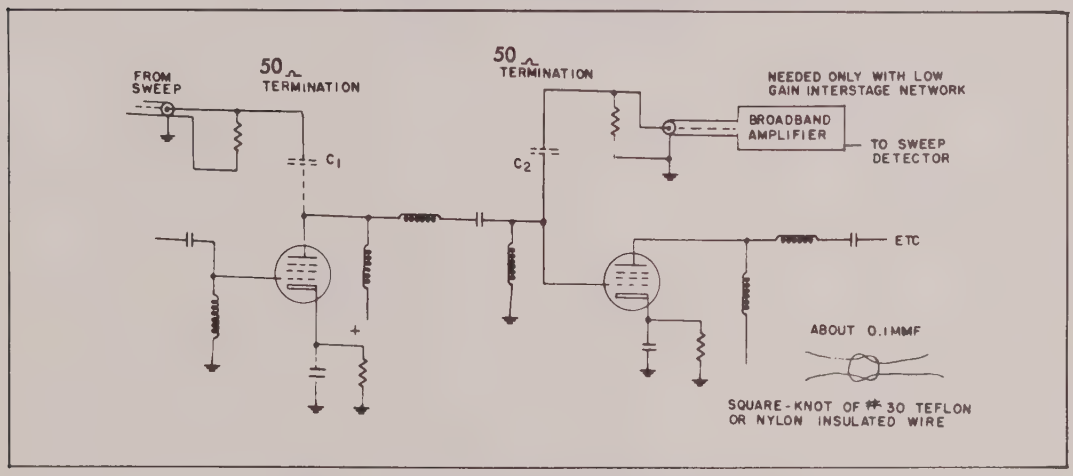



Fig. 28—Setup for Testing an Amplifier Stage, Method 2

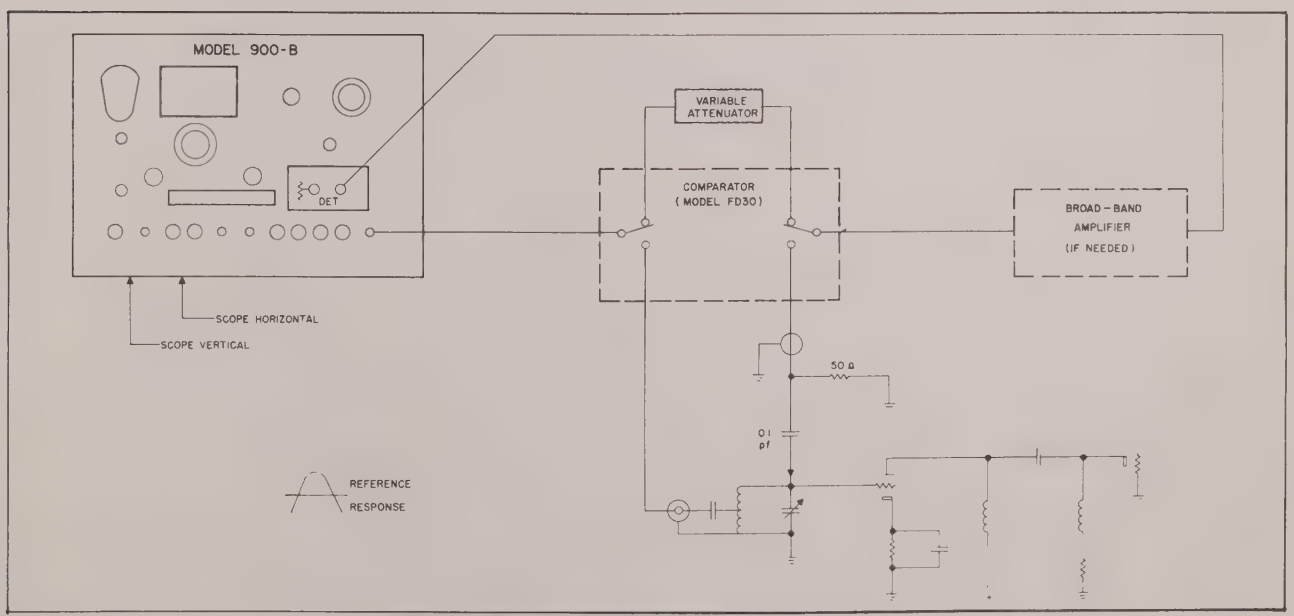



Fig. 29—Setup for Testing Input and Output Circuits

3. Reverse the connections to the circuit under test.
4. Adjust the variable attenuator as in step 2.
5. The difference between the attenuator settings in steps 2 and 4 is the gain (or loss) of the circuit under test.

## 4-9. DETERMINING THE FREQUENCY RESPONSE AND LOSS OF FILTERS AND TRANSFORMERS

The general technique for testing passive circuits is the same as that employed for testing amplifiers, except that more system gain is required. Fig. 30 illustrates a typical set-up for displaying the response of a filter. Matching pads (M1 and M2) are required when the terminal impedance of the filter differs from that of the 900-B.

For testing filters with losses greater than 50 db, an amplifier with a flat response over the range of interest must be added to the test set-up.

When deep rejection notches are observed within a band, the effects of distortion in the 900-B sweep output can be minimized by feeding the sweep signal through a low-pass filter which cuts off just above the band of interest and by setting the RF OUTPUT control for the lowest signal level that will permit adequate display of the response curve.

A transformer whose secondary impedance differs from that of its primary can be tested by employing matching pads at each winding or by connecting two identical transformers back-to-back to permit testing at a common impedance.

Measurements with an error of less than 0.1 db are possible with the comparison technique (Fig. 31) provided that the reference attenuator has a high degree of accuracy and that the lengths of cable connecting the attenuator are carefully matched to those connecting the device under test.

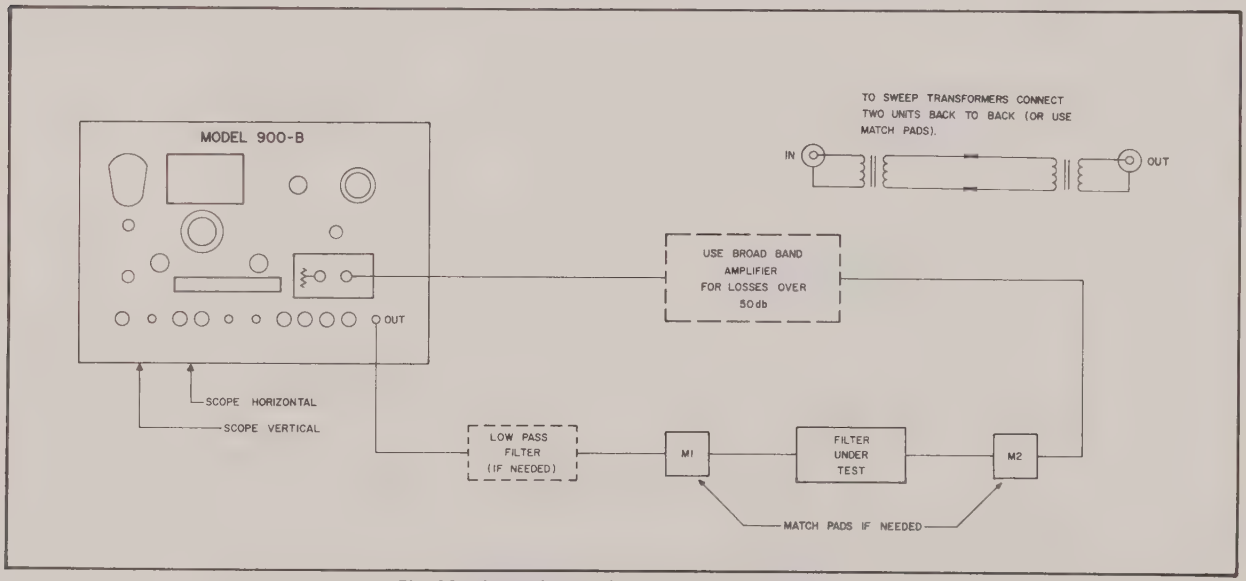



Fig. 30—Setup for Testing Filters or Transformers

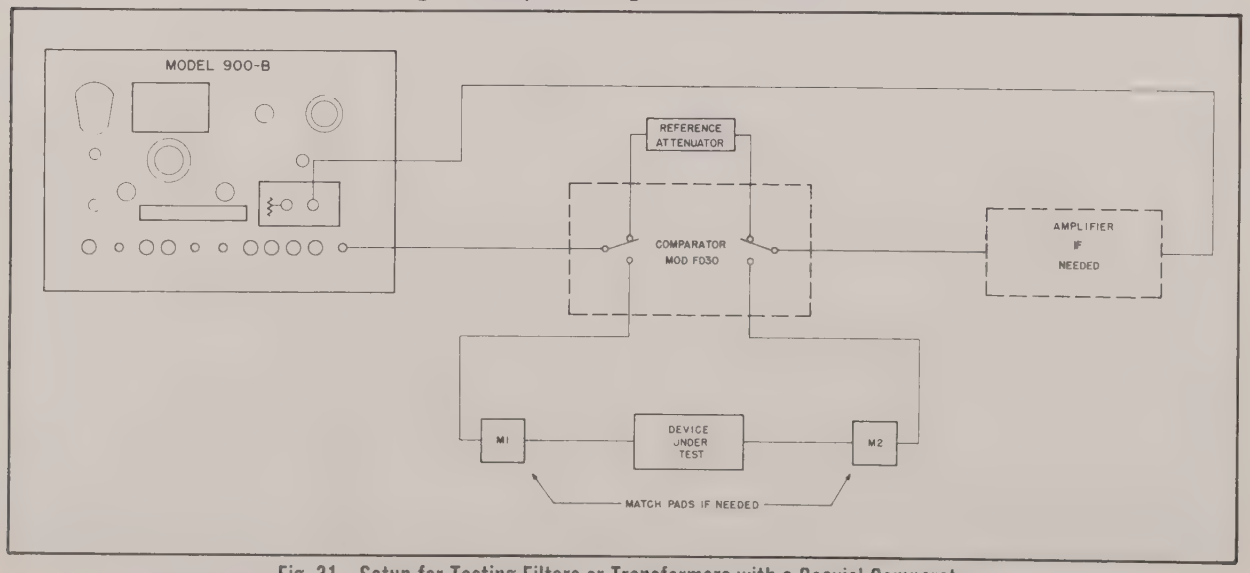



Fig. 31—Setup for Testing Filters or Transformers with a Coaxial Comparator

## 4-10. DETERMINING THE UNLOADED BANDWIDTH OF CAVITY RESONATORS

With its stable narrow-band performance, the 900-B is an excellent instrument for observing and measuring the response of narrow-bandwidth devices such as cavity resonators. The sweep signal and the detector input are loosely coupled to the cavity under test (Fig. 32). The bandwidth of the response is measured by using the sideband marker technique to determine the width of the curve at the 3-db down points between the fundamental marker and the sideband marker.

Carefully done, this technique yields measurements which are accurate to within a few percent. Keep in mind that the probes load the cavity to the extent to which they are coupled to it. Use the least coupling that will allow observation of the response curve and adjust both probes for approximately the same coupling. When the probes are coupled so as to give an insertion loss of 20 db (as compared with a direct connection) they introduce an error of about 5% in the bandwidth. If the loss is increase to 40 db, the error is reduced to about 1%. Error will also be introduced when there is direct coupling between the probes. The presence of this coupling can be determined by shorting the cavity and observing the oscilloscope display to see that no measurable response is indicated.

## 4-11. IMPEDANCE TESTING WITH A DELAY LINE

One of the most useful applications of a sweep generator is in finding how well a device terminates a transmission line.

Fig. 33 illustrates the test set-up. The 900-B ATTENUATOR switch should be set for 10 db attenuation since the impedance shown to the generator by the input end of a mismatched line changes so rapidly and over such extreme values that proper ALC action in the 900-B is difficult to obtain unless some attenuation is added.

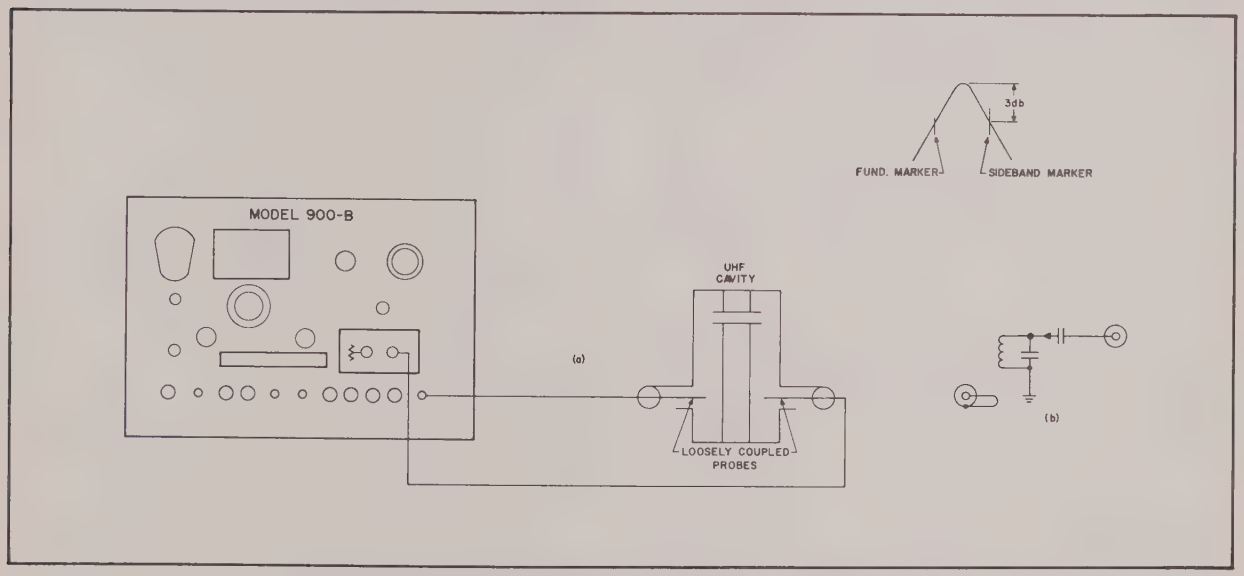



**Fig. 32—Setup for Determining the Bandwidth of a Cavity Resonator**

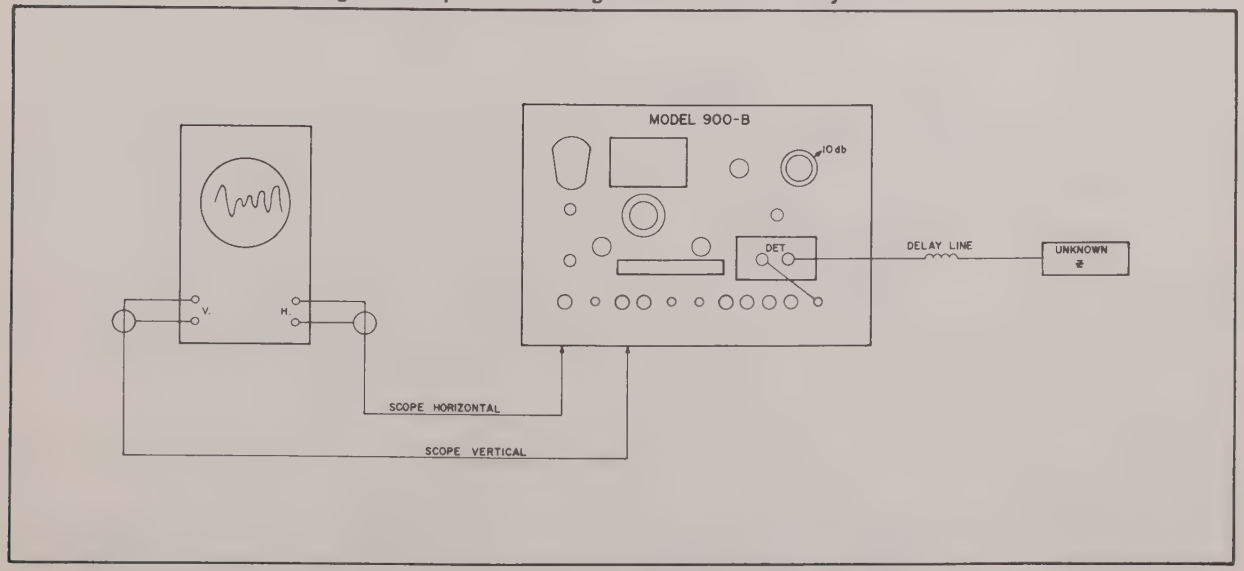



**Fig. 33—Setup for Impedance Testing with a Delay Line**

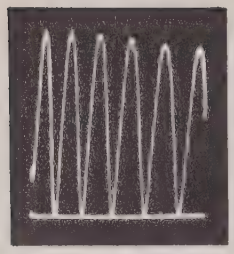


Fig. 34—Response Display of a Delay Line Terminated in on Open Circuit

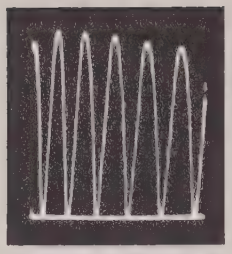


Fig. 35—Response Display of a Delay Line Terminated in a Short Circuit

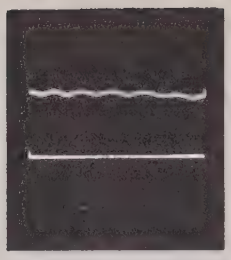


Fig. 36—Response Display of a Delay Line with Broadband Termination

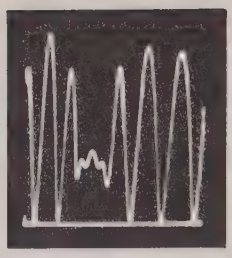


Fig. 37—Response Display of a Delay Line with a Termination which matches Over a Portion of the Swept Band

Figs. 34 to 37 show patterns which may be obtained. With the sweep signal covering the range of 50-100 mc and with a 33-foot section of RG-11/U serving as the delay line, an open circuit at the end of the line results in maximum ripple height on the display (Fig. 34). Shorting the end of the line results in a display similar to Fig. 35. A broadband termination at the end of the line gives minimum ripple across the band as shown in Fig. 36.

The degree of match at specific frequencies is indicated by ripple height at the portion of the display which represents the frequency of interest. Fig. 37 shows the display pattern which results when the termination matches over a portion of the swept band.

The frequency spacing between peaks of the ripple pattern is determined by the length of the delay line and the dielectric material of the line, and can be calculated from the following equation:

$$F = \frac{492\ d}{L}$$

Where frequency (F) is expressed in mc; L is the delay line length, in feet; and d is the ratio of the velocity of propogation in a particular type of cable to the velocity in air. Typical values for d are 0.67 for solid polyethylene dielectric cable and 0.8 for polyfoam dielectric cable.

Refer to Jerrold Technical Newsletters, appended to this manual, for more detailed discussions of impedance measurements.

## 4-12. SWEEPING OF COAXIAL CABLES USING AN R-F BRIDGE

An important application of the sweep frequency measurement technique is the testing of coaxial cables by employing a variable r-f bridge for measuring the cable's reflection coefficient. The bridge (Jerrold Model KSVB-7N) used in this test is diagrammed in Fig. 38. The test set-up is shown in Fig. 39. When the variable standard arm of the bridge is adjusted to equal the average characteristic impedance of the cable, the bridge acts as a directional coupler with directivity in excess of 50 db and a constant insertion loss of about 12.5 db.

The variable attenuator generates a reference trace which is set to cross the cable response curve at peaks of the reflection characteristic. Since the measurement is made in dbs, the results are most conveniently expressed in these terms. Thus the reflection coefficient expressed in db is the characteristic return loss of the cable under test; it is known as the cable's "structural return loss." (See also Jerrold Technical Newsletter, Vol. 2, No. 1).

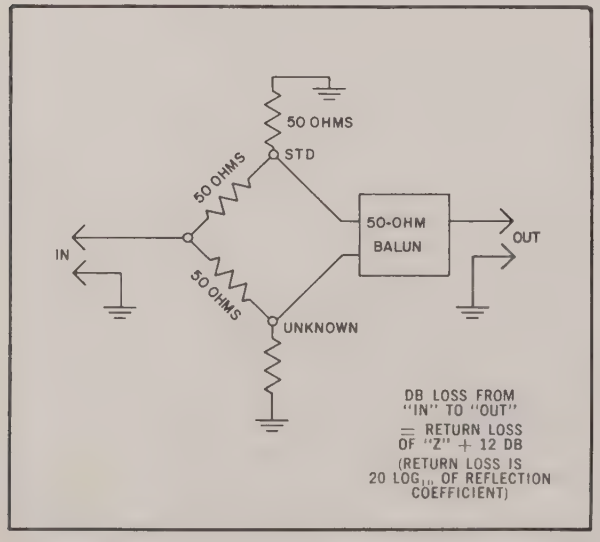



Fig. 38—R-F Bridge Used for Impedance Measurements

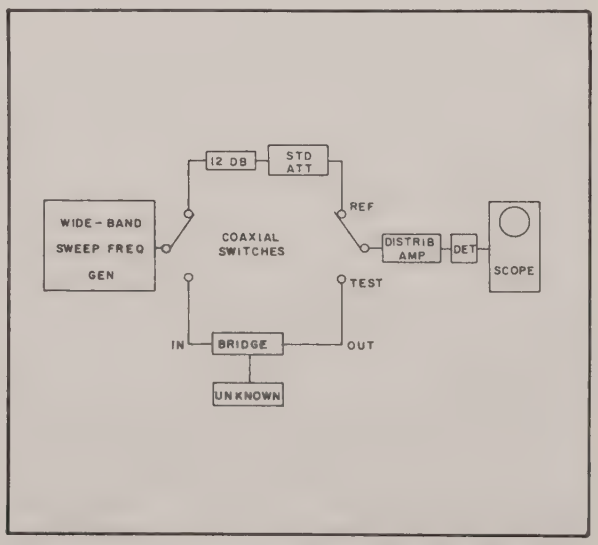



Fig. 39—Setup for Impedance Testing with an R-F Bridge

# SECTION 5
# Circuit Description

## 5-1. GENERAL (See Fig. 40)

The uhf sweep oscillator, a tunable oscillator which operates from 275 to 1200 mc, forms the heart of the 900-B. The frequency of its output is modulated by a variable, air-dielectric capacitor mounted on a voice coil mechanism. This modulating device, called a wobbulator, is driven by an a-c voltage derived from the power transformer.

The sweep oscillator yields three output signals. One is applied to the BAND SELECTOR switch. In the UHF position, this switch feeds the oscillator signal through the r-f attenuator to the RF OUTPUT terminal. If the BAND SELECTOR switch is in the VHF position, the same sweep oscillator signal is applied to a mixer circuit where it beats with the 600 mc signal generated by the fixed oscillator. The resulting signal is filtered to remove the sum frequencies and then fed to the RF OUTPUT terminal through the attenuator. The filtered signal also drives the VHF-ALC (automatic level control) detector.

A second output from the sweep oscillator operates the UHF-ALC detector. The signal from this detector (or from the VHF-ALC detector, depending on the band of operation) operates the 900-B output meter and is fed to the ALC amplifier where it is employed to maintain the sweep oscillator signal at a constant level.

A third output from the sweep oscillator is applied to the harmonic marker generator. Here the sweep signal mixes with the 1, 10, and 100 mc signals and their harmonics, to generate three groups of marker signals which are amplified and added to the detected sweep signal.

A portion of either the UHF or VHF signal, depending on the position of the BAND SELECTOR switch, may be mixed in the external marker mixer with externally generated signals to yield markers. The amplitude of these markers is controlled by the marker MASTER GAIN control; the markers are amplified and applied to the SCOPE VERT terminal.

The sinewave voltage appearing at the SCOPE HORIZ terminal is derived from the power transformer. This signal is also coupled to the ALC amplifier where it becomes the retrace blanking signal.

The input to the 900-B oscilloscope preamplifier can be derived either from the D-50B detector or from an external detector. In either case, the phase of the detected signal, as it is applied to the preamplifier, is determined by the position of the POL switch.

## 5-2. POWER SUPPLY

Power for operating the 900-B is provided through regulated transformer T1 (Dwg. No. 861-388). The 115V-230V switch, SW13, in the primary circuit of T1, permits operating the supply from either 115-volt or 230-volt a-c sources. Adaptation for operation from 50-cycle or 60-cycle power sources is accomplished simply by mating plug P16 with receptacles S1 or S2, respectively. Fuse FS1 protects the 900-B from damage in the event the unit is plugged into a 230-volt line while the 115V-230V switch is set to 115V.

The +150-volt output of the supply is derived from full-wave rectifier CR1 and CR2 and the filter circuit consisting of C4, C5, CH1 and CH2. The —150-volt output is derived from half-wave rectifier CR3 and the filter circuit consisting of C2, C3 and CH3. These voltages are regulated by gas diodes V1 and V2, respectively.

Two balanced filament supplies are provided, one for the sweep oscillator and the second for the ALC circuits. An unbalanced winding on T1 supplies power to the marker generator filaments, the pilot lights and two low-voltage supply circuits. The first of these, consisting of rectifiers CR5 and CR6 and filter network R43, C13, C14, furnishes d-c power for the preamplifier filaments. The second, consisting of CR4 and filter capacitor C12, furnishes d-c power to relays RLY1, RLY2 and RLY3, and to the fine tuning circuits.

## 5-3. UHF SWEEP OSCILLATOR

The uhf sweep oscillator is a tuned plate, grounded grid circuit employing a modified 5675 pencil triode, V601 (Dwg. No. 861-389). The grid disc of the tube is clamped to a disc-shaped capacitor which provides a low impedance path to ground for r-f signal voltage. The modification of the 5675 is in the removal of a portion of the grid disc. This permits the use of a low inductance tab as a means for achieving the necessary regenerative feedback from plate to cathode.

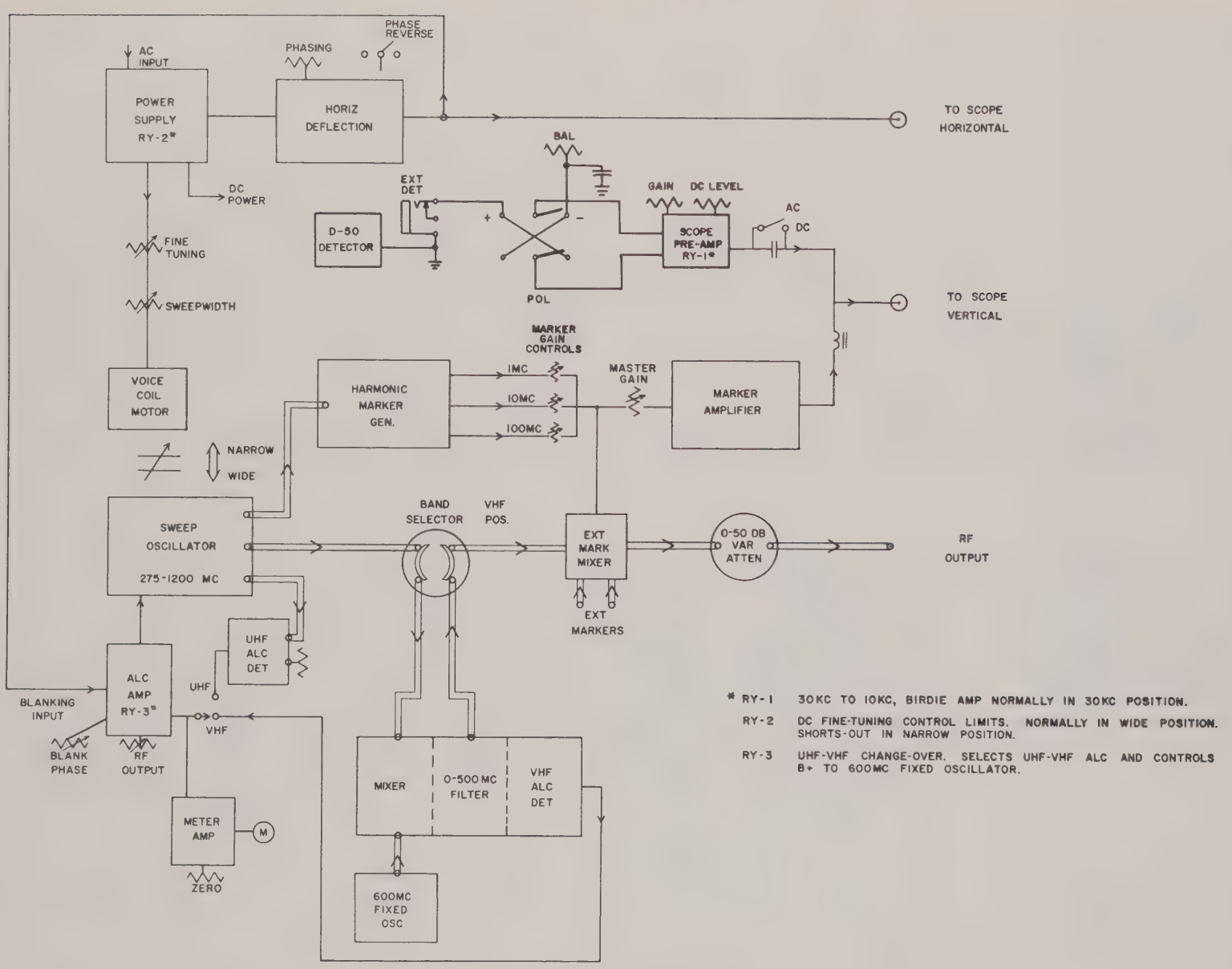
The operating frequency of the oscillator is controlled by a high-Q plate circuit consisting of a coaxial line section and the wobbulator capacitor.

The oscillating plates of the wobbulator capacitor are mounted on a voice coil mechanism which is driven by a voltage from T1. Thus they oscillate at the power line frequency. This varies the capacitance of the wobbulator capacitor and therefore the frequency of the oscillator signal.

The center frequency of the oscillator signal is set by the FREQUENCY MEGACYCLES control, which moves a shorting plunger in the coaxial section to control its resonant frequency.

V601 is operated with its plate at d-c ground potential and its cathode connected to a negative supply through V303 and V304 in the ALC amplifier. The ALC amplifier thus controls the sweep oscillator plate current and therefore the sweep output level.

Three probes, each of which is terminated to obtain good source match and flat response, are capacitively coupled to the coaxial section. In its UHF position, the BAND SELECTOR switch, SW5, feeds the sweep signal through a marker inserter




* RY-1 30KC TO 10KC, BIRDIE AMP NORMALLY IN 30KC POSITION.

RY-2 DC FINE-TUNING CONTROL LIMITS. NORMALLY IN WIDE POSITION. SHORTS-OUT IN NARROW POSITION.

RY-3 UHF-VHF CHANGE-OVER. SELECTS UHF-VHF ALC AND CONTROLS B+ TO 600MC FIXED OSCILLATOR.

Fig. 40—Model 900-B, Block Diagram

circuit and an adjustable (0-50 db) r-f attenuator to the RF OUTPUT terminal, J4. In its VHF position, the BAND SELECTOR switch couples the sweep oscillator signal to a mixer where it beats with the output of the fixed oscillator, V201.

The second probe couples some of the oscillator signal to the UHF-ALC detector CR101 and CR102, whose output drives the ALC amplifier. Finally, the third probe couples a portion of the sweep signal to the harmonic marker generator.

### 5-4. WOBBULATOR CIRCUITS, U. S. Patent No. 3, 140, 454 (See Dwg. No. 861-388).

The wobbulator essentially consists of a variable air dielectirc capacitor and a loudspeaker voice coil mechanism. The capacitor has four fixed plates mounted on the sweep head assembly, and four movable meshing plates which are mounted on the voice coil mechanism. As the voice coil mechanism is driven, the position of the meshing plates, and therefore the value of capacitance, changes. Thus the resonant frequency of the sweep oscillator plate circuit is varied so that the oscillator output is frequency-modulated.

The wobbulator may be driven either by an externally generated voltage or, at the line frequency, by an internally generated voltage. External drive voltage is applied to the six-prong socket S5 (Dwg. No. 861-388).

The internal drive voltage is derived from a winding on power transformer T1 and fed to SWEEP WIDTH control R9, which controls the amplitude of the sine-wave voltage applied across the primary of step-down transformer T3. The secondary of T3 is connected across the wobbulator voice coil mechanism. The WOBB DRIVE LIMIT control, R6, limits the voltage available to T3 so that the wobbulator is prevented from being driven to the point where it chatters. Capacitor C9 resonates the primary of T3 to improve the voltage waveform thereby assuring linear sweep.

Fine tuning of the sweep signal center frequency is accomplished by the FINE TUNING control, R14, which sets the amplitude of a d-c voltage applied across the voice coil. This shifts the starting position of the wobbulator capacitor. Capacitors C10 and C11 prevent the flow of d-c current in the secondary of T3. Choke CH4, in series with the FINE TUNING control, prevents shunting of the wobbulator drive voltage.

Fine tuning requires greater movements of the meshing plates of the capacitor when the NARROW position of the SWEEP WIDTH switch is selected. When this mode is selected, relay RLY2 is energized, shorting resistor R15, in series with CH4, to increase the control voltage available across the FINE TUNING control.

### 5-5. VHF CIRCUITS

For operation in the VHF range, the 900-B functions as a beat frequency oscillator. Contacts of relay RLY3, energized in this mode, apply B+ to the grounded grid oscillator V201, which operates at 600 mc. The PLATE TUNING trimmer, C206, and the CATHODE TUNING trimmer, C201, are alignment controls. The FIXED OSCILLATOR FREQUENCY trimmer, C205, is a tuning adjustment accessible at the front panel of the 900-B. This adjustment establishes the accuracy of the harmonic markers on the VHF range.

The output probe of the fixed oscillator is capacitively coupled to the plate circuit and connects through a coaxial cable to coupling loop L710 in the mixer. The loop couples driving voltage to mixer diodes CR701 and CR702. The output of the sweep oscillator is applied to the mixer diodes also, through the filter circuit consisting of C701, C702, C703, and L701. This filter prevents low-frequency beats from coupling back into the sweep oscillator.

The output of the mixer is fed through a low pass filter, which passes frequencies up to 450 mc and greatly attenuates signals of higher frequencies. From the filter the signal passes through the VHF OUT terminal J702 to the BAND SELECTOR switch SW5 and from there through the marker mixer circuit and the r-f attenuator network to the RF OUTPUT terminal J4. A portion of the mixer output is coupled through C708 to the VHF ALC detector diodes CR703 and CR704 which are part of the ALC circuitry.

### 5-6. AUTOMATIC LEVEL CONTROL CIRCUIT

The automatic level control circuit consists of the VHF-ALC and UHF-ALC detectors (Dwg. 861-389) and the ALC amplifier (Dwg. 861-383). Depending on the operating mode, the output of one or the other ALC detector is applied through contacts of relay RLY3 to the high-gain, two-stage amplifier employing V301, V302 in the first stage, and V303, V304 in the second stage. The ALC BIAS, ALC GAIN, and RF OUTPUT controls all affect the output level of the first stage. Since V303 in the second stage is in the path of the sweep oscillator current, the signal applied to the second stage controls the current available to the oscillator and hence its output level. As the signal voltage from the detector increases, indicating an increase in the r-f output level, conduction through V303 decreases; this reduces the sweep oscillator current and therefore the output level. Conversely, with a decrease in detector output, the sweep oscillator output level increases.

### 5-7. METER CIRCUIT (See Dwg. 861-383)

The meter circuit uses the variations in detector output to indicate r-f output level. Depending on the operating mode, the balanced d-c amplifier V305 is connected across the VHF ALC or the UHF ALC detector; with the meter connected between the cathodes of the two triode sections in V305. Potentiometer R304, connected in series with the meter, permits meter calibration for vhf operation. Meter calibration for uhf operation is provided by potentiometer R333, in the path of the UHF-ALC DET output. METER ZERO switch SW11 disables the sweep oscillator to permit zero adjustment of the output meter.

### 5-8. HORIZONTAL DEFLECTION AND BLANKING CIRCUITS

The horizontal deflection voltage for the oscilloscope used with Model 900-B is derived from a tap on the secondary wind-

ing of T1 in the power supply section (Dwg. 861-388). This voltage is applied through R7 to the primary of transformer T2. The primary of T2 is made resonant at the line frequency to filter out distortion in the a-c voltage applied to it. The secondary of T2 is balanced by R8 and C8 to permit phase adjustment of the horizontal deflection voltage over a range of approximately 180°. The PHASE REVERSE switch S4, extends the control range to approximately 360° by inverting the signal. This switch also controls sweep direction: in one position the switch causes the 900-B to sweep from the low frequency to the high frequency, in the other position it causes the 900-B to sweep from the high frequency to the low frequency. From the R8/C8 network the signal is brought out to the SCOPE HORIZ terminal J1.

It is often desirable to reduce the output level of the sweep generator to zero during retrace. In "blanking" the retrace, horizontal phasing becomes less critical and the zero level retrace line provides a convenient reference.

Blanking is achieved in the following circuit (Dwg. 861-383): A portion of the horizontal deflection voltage is applied through BLANKING switch SW10 to a phasing network in the grid circuit of the first blanking amplifier stage, using one triode section of V306. This stage clips the positive peaks of the input sinewave. The resulting signal drives the second amplifier stage (second triode of V306) between cutoff and saturation. When the second stage conducts, its output causes V303 and V304 in the ALC amplifier to cut off: hence the sweep oscillator is disabled and its output falls to zero. When the second blanking amplifier stage is cut off, the ALC amplifier functions normally.

The BLANKING switch SW10 permits disabling the blanking circuit when both trace and retrace are wanted on the oscilloscope.

**5-9. MARKER GENERATING CIRCUITS** (See Dwg. No. 861-386).

The internal marker generating system yields markers at all harmonics of 1, 10, and 100 mc, within the frequency range of the 900-B.

The frequency standard in the marker generator is a 5 mc crystal-controlled oscillator V401A, whose output takes two paths. The resonant circuit consisting of L402 and C403 couples the 5 mc signal to blocking tube oscillator V401-B, synchronizing it at 1 mc. The 1 mc signal, very rich in harmonics, is fed to diode CR402 where it mixes with the sweep oscillator signal to produce a beat signal (marker) each time the sweep oscillator frequency passes through a multiple of 1 mc. The 1 mc marker signals are fed to R21, the 1 MC marker gain control.

The second path for the 5 mc oscillator signal leads to V402, a frequency multiplier circuit. The plate circuit of V402 is resonant at 10 mc so that the frequency of its output signal is also 10 mc. This signal drives CR403 to produce a spectrum of 10 mc harmonics which mixes with the sweep oscillator signal in CR404 to generate markers at harmonic multiples of 10 mc. These marker signals are applied to the 10 mc marker gain control, R22. The signal from V402 also drives frequency multiplier V403-A, whose plate circuit is resonant at 50 mc.

The 50 mc signal thus generated is applied to frequency doubler V403-B. The resulting 100 mc signal is shaped by CR405 and mixed with the sweep oscillator signal in CR406 to generate 100 mc markers which are coupled to R23, the 100 MC marker gain control.

Cw signals from external marker generators are applied through J2 and J3 to mix with the sweep signal in diode CR801. The marker signals so generated are combined with the internal markers at the MASTER GAIN control. All marker signals are applied through P504 to the marker amplifier.

**5-10. MARKER AMPLIFIER** (See Dwg. No. 861-387).

The marker signals from the MASTER GAIN control are coupled to a two-stage amplifier, V503-A and V503-B. In the wide sweep mode, the response of the amplifier is peaked at about 30 kc by resonant circuits in both amplifier stages. When the SWEEP WIDTH switch is set to NARROW, relay RLY1 energizes and its contacts connect capacitors C510 and C513 into the resonant circuits so that the amplifier response is peaked at about 10 kc instead.

The amplified marker signals are applied across the primary of transformer L502. The secondary of L502 is connected in series with the output of V502 in the oscilloscope preamplifier. The markers are thus fed to the SCOPE VERT terminal without affecting the preamplifier response characteristics.

**5-11. OSCILLOSCOPE PREAMPLIFIER AND D-50B DETECTOR** (See Dwg. No. 861-387).

The D-50B detector uses two silicon diodes CR901 and CR902 in a full-wave circuit. To minimize the effects of hum, the detector output is balanced to ground and amplified in a balanced circuit which has high rejection of unbalanced hum components. A phone jack, J502, allows the use of another detector, at the same time disconnecting the D-50B detector.

The preamplifier employs two triodes, V501, in the first stage and two transistors, Q501 and Q502, in the second stage. Either of the two amplifier inputs (pins 2 and 7 of V501) may be used as the "high" side, with the other side grounded, depending on the position of the POL switch, SW501. Inverse feedback is provided by resistors, R529 and R538, connected between the transistor collectors and the tube cathodes. The amount of feedback and thus the gain of the amplifier is controlled by GAIN control potentiometer R506. The BAL control, dual potentiometer R527, adjusts the grid voltages on V501 so that gain adjustment does not shift the reference level of the preamplifier output.

When the preamplifier gain is set near maximum there is a slow d-c drift which would require occasional readjustment of oscilloscope vertical centering with the DC LEVEL control, R37. The AC-DC switch, SW12, is provided to eliminate this effect. In the AC position, SW12 inserts a-c coupling (C524) between the transistors and cathode follower V502. Capacitor C25 maintains low frequency response when a-c coupling is employed. The output of V502 is applied to the SCOPE VERT fitting J501.

# SECTION 6
# Maintenance

## 6-1. GENERAL

This section includes procedures for replacing K3-A diodes and the electron tubes in the fixed and sweep oscillators. Alignment and calibration procedures are also included. The troubleshooting chart (Table 4), the replacement parts list and the schematic diagrams are provided as aides in identifying sources of equipment malfunctions. Illustrations in this section show the physical location of important components.

If for some reason the unit cannot be repaired in the field, the instrument may be returned to the Jerrold Laboratory, Byberry Rd. and the Penna. Turnpike, Hatboro, Penna. After notifying Jerrold of your intention to return the unit for repair, carefully pack the unit and ship it (with freight and insurance prepaid) together with a note stating the serial number of the unit and listing the difficulties encountered. The instrument will be repaired free under conditions of warranty. Otherwise it will be repaired and returned at nominal charges.

## 6-2. REPLACEMENT OF COMPONENTS

### 6-3. Replacement of CR101, CR102, CR901 and CR902 (See Fig. 41).

1. Disconnect the 900-B from its power source.
2. For access to the UHF-ALC detector, remove the mixer chassis as described in paragraph 6-10, steps 14 and 15. Where a D-50B diode is to be replaced, first remove the detector from the 900-B.
3. Remove the eight screws holding the detector front panel to the casting and withdraw the panel.
4. The two crystal diodes, CR101 and CR102, will be found held in clips mounted on the inside of the detector panel. Observing proper polarity, replace the faulty diode. Ensure that replacement diodes bear the proper color coding.
5. Now, when replacing the panel, see that the protruding parts of the diodes are correctly positioned to freely enter the openings of the filter barrels. If necessary, remove the top cover of the detector to gain a better view of the interior. Then fasten the panel with the eight screws.
6. For diodes CR901 and CR902 in the D-50B detector, follow the same procedure as in steps 3 to 5 above.

### 6-4. Replacement of Mixer Diodes CR701 and CR702 (See Figs. 42 and 43).

1. Disconnect the 900-B from its power source.
2. Remove the four screws securing the top cover on the mixer, and remove the cover.
3. Bend the coupling loop at J703 up and out of the way.

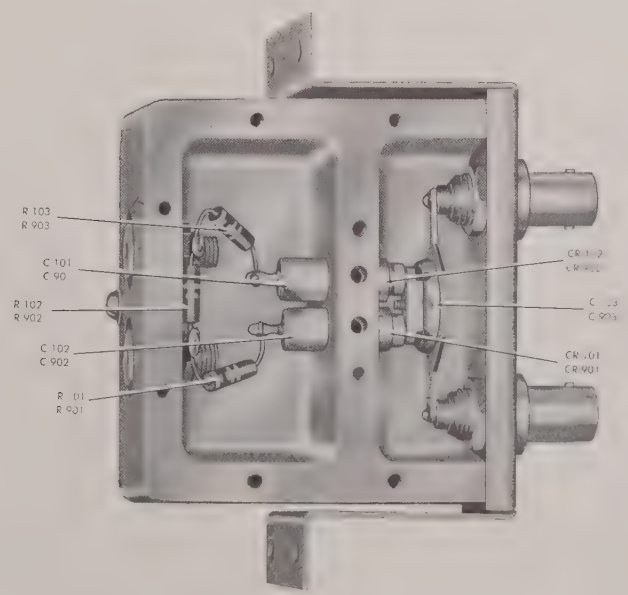



Fig. 41—D-50B and UHF-ALC Detectors with Top Cover Removed

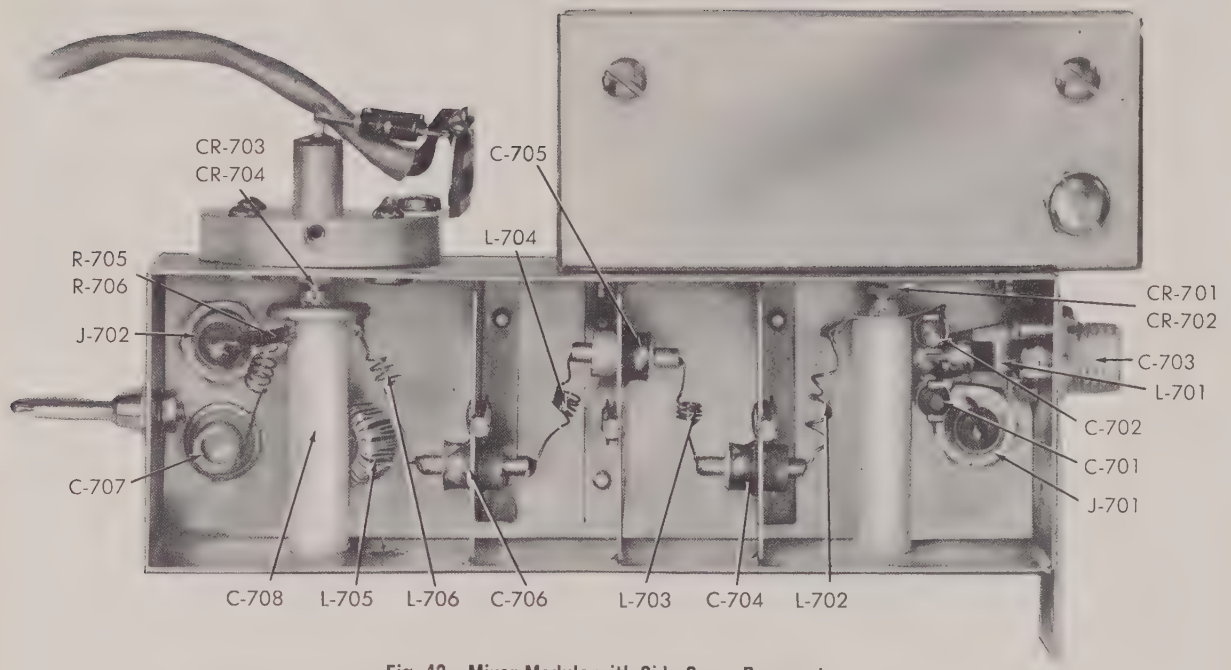



Fig. 42—Mixer Module with Side Cover Removed

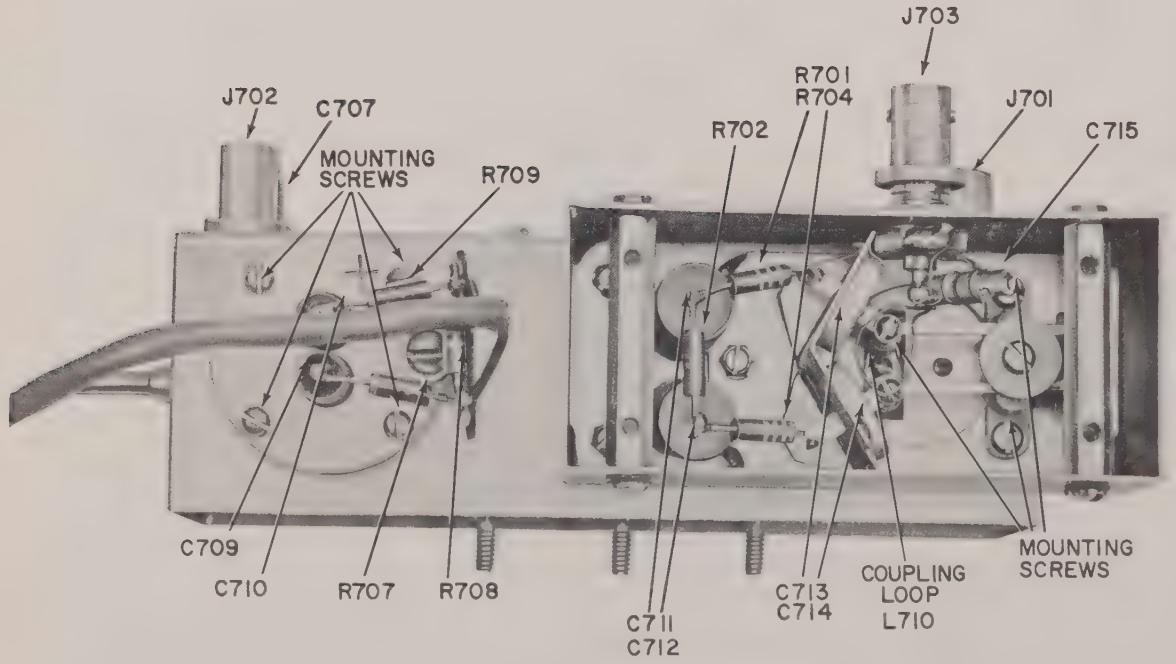



Fig. 43—Mixer Module with Top Cover Removed

4. Remove the three screws holding the subassembly plate in place. One screw is located between C713 and C714; the other two hold the insulator.
5. Lift the subassembly plate far enough to disengage the crystals from their clips, and maneuver the plate out of the housing. If necessary, remove the cross bar.
6. Observing proper polarity, insert the replacement crystal into the chassis clip, not the plate clip.
7. Carefully replace the subassembly plate, seeing that the plate clips properly engage the crystals; fasten the plate with the screws.
8. Return the coupling loop to its initial position.
9. The cover may now be returned to the mixer chassis and the 900-B returned to service; however, the performance of the unit will be somewhat less than optimum. To obtain completely satisfactory operation, it will be necessary to align the mixer as described in paragraph 6-10.

**6-5. Replacement of VHF-ALC Diodes CR703 and CR704** (See Figs. 42 and 43).

1. Remove the four screws attaching the round plate to the mixer chassis; remove the plate.
2. Observing proper polarity, replace the faulty crystal in the clip mounted on mixer chassis. If necessary, remove the side cover to obtain a better view of the interior.
3. Carefully replace the plate; see that the plate clips properly engage the crystals and that the r-f gasket is seated in the machined groove in the plate. Fasten the plate to the chassis with the four screws.

**6-6. Replacement of Fixed Oscillator V201** (See Fig. 45).

1. Disconnect the 900-B from its power source and remove the unit from its cabinet or rack.
2. Set the unit on its side (power transformer down) to gain access to the underside.
3. Loosen the set screw at the front panel end of the hollow guide leading to the FIXED OSCILLATOR FREQUENCY trimmer C205 and slide the guide off the trimmer shaft.
4. Unsolder the B+ and filament leads.
5. Remove the four screws attaching the fixed oscillator housing, and remove the housing by guiding it out of its mounting channels.
6. Grasp V201 at both ends and gently pry the tube out of the spring clips which hold it in place.
7. Carefully pull the filament socket from the tube.
8. Insert the replacement tube filament pins into the socket.
9. Line up the grid flange of the replacement tube with the grid clip on the housing and gently push the tube into the spring clips.
10. Replace the housing and the four mounting screws.
11. Reposition the hollow guide and tighten its set screw.
12. Reconnect the filament lead.
13. Complete the alignment procedure given in paragraph 6-11.

**6-7. Replacement of UHF Sweep Oscillator V601**

1. Disconnect the 900-B from its power source and remove the unit from its cabinet or rack.
2. Remove the four screws on the end plate of the sweep oscillator housing; remove the plate.
3. Unsolder the filament and cathode leads to V601.
4. With one or two turns, loosen the three screws (Fig. 46) that clamp the grid flange of the tube. Turn the Teflon shoulder washers so that the flat portions face the tube.
5. Grasp the cathode sleeve and slowly draw the tube straight out.
6. At this point an examination will reveal a spring contact cylinder inside the oscillator tube housing (Fig. 47).

   This should be pushed in to make certain it is seated properly before the replacement tube is inserted.

   Failure to do this may result in the tube breaking when the grid flange is screwed tight. When looking into the cavity, the open part of the spring contact cylinder should be at the 9 o'clock position (see Fig. 47).

7. The Jerrold-modified 5675 tube is furnished with the cathode sleeve and feedback tab attached. Gently insert the replacement tube plate end first into the spring contact cylinder. The feedback tab must be positioned so that it slips into the cylinder opening.

**CAUTION**

THIS OPERATION IS DELICATE. ANY UNUSUAL STRAIN ON THE TUBE WILL BREAK IT AT THE METAL-GLASS SEAL.

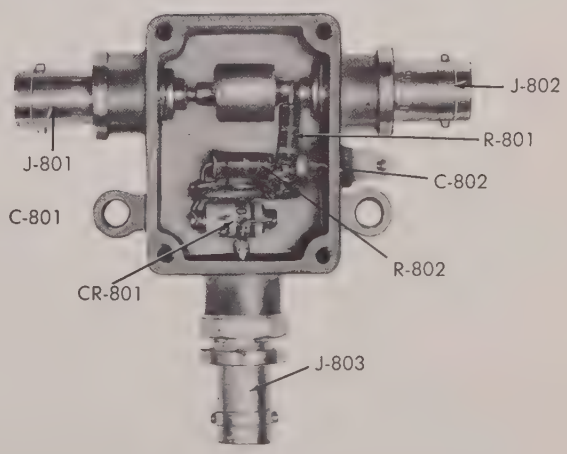



**Fig. 44—External Marker Mixer with Cover Removed**

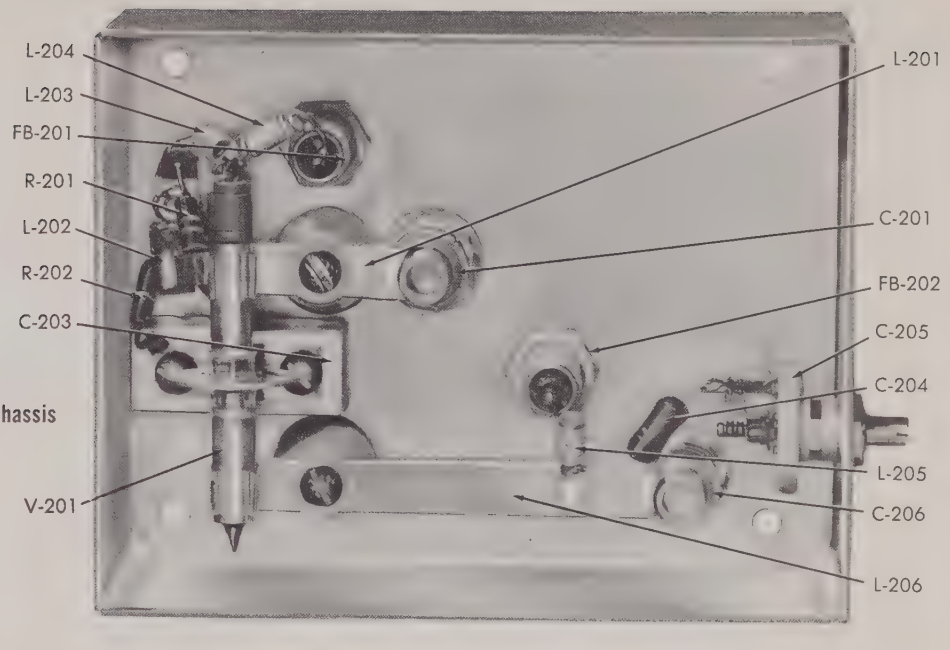



Fig. 45—Fixed Oscillator Chassis

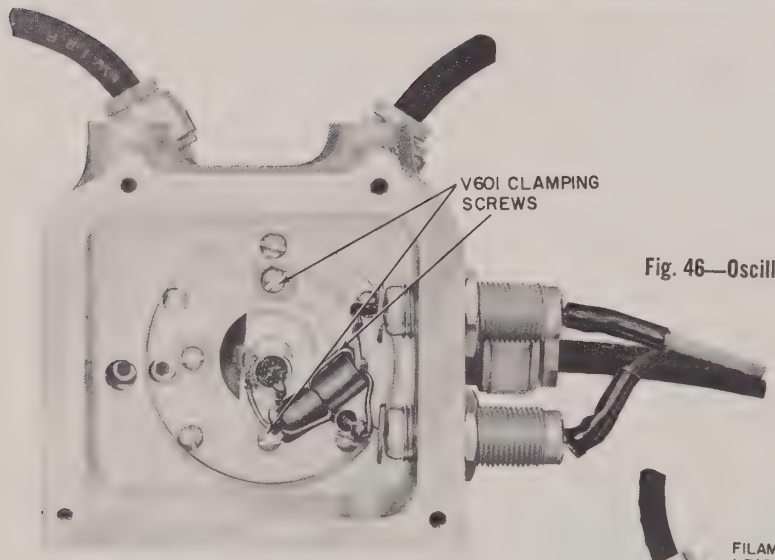



Fig. 46—Oscillator Section of Sweep Head with V601 in Place

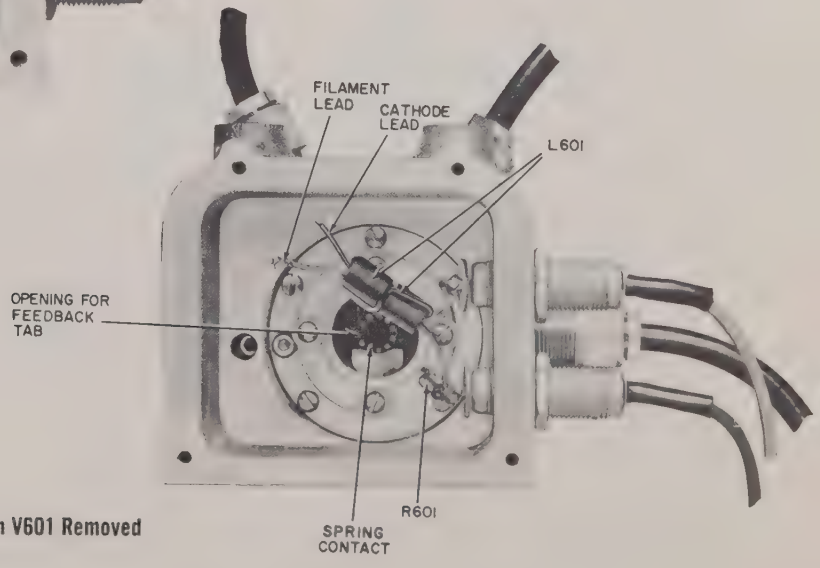



Fig. 47—Oscillator Section of Sweep Head with V601 Removed

8. If the grid flange of the tube does not seat flush with the metal clamping ring, the spring contact cylinder was not pushed in far enough. In this event, withdraw the tube, push the cylinder farther in, and then replace the tube.
9. Return the Teflon shoulder washers to their original positions.
10. Alternately tighten each screw for even distribution of pressure; do not over-tighten.
11. Solder the filament and cathode leads to the tube.
12. The feedback tab must be adjusted (paragraph 6-12). After this procedure has been completed, replace the end plate and fasten it with the four screws.
13. The replacement of V601 will somewhat offset the calibration of the 900-B. If the resulting calibration error is tolerable, the 900-B may now be returned to service. If it is not, complete the calibration procedure given in paragraph 6-14.

## 6-8. ALIGNMENT AND CALIBRATION PROCEDURES

### 6-9. Equipment Required

1. Bolometer, Hewlett-Packard Model HP-430C, or equivalent.
2. Dc-coupled oscilloscope, Hewlett-Packard Model HP-120, or equivalent.
3. Variable attenuator, Jerrold Model AV-50 (AV-75 for 75-ohm versions of Model 900-B) or equivalent.
4. Coaxial Comparator, Jerrold Model FD-30, TC-3, or equivalent.
5. 16 mc cut-off filter for adjustment to reduce spurious mixer beats (see appendix).
6. 15 mc bandpass filter for adjustment to reduce mixer harmonics (see appendix).
7. Vacuum-tube voltmeter, RCA Model WV-77E.
8. Rack-setting gauge, Jerrold Part No. 209-212 (Fig. 55).
9. Wrench for wobbulator locking screws, Jerrold Part No. 209-010 (Fig. 55).
10. Head mounting wrench for sweep head mounting screws, Jerrold Part No. 209-011 (Fig. 55).
11. Switch shaft removal tool, Jerrold Part No. 209-008 (Fig. 55).
12. Capstan wrench, 3/8 x 5/16, Jerrold Part No. 209-013 (Fig. 55).
13. Power cable extension made from 15 inches of five conductor cable, a six-prong Jones receptacle and a six-prong Jones plug.
14. R-f probe cable extension made from 24 inches of RG-55 A/U cable and two UG-88/U connectors.
15. Marker probe cable extension made from 11 inches of RG-55 A/U cable and two UG-88/U connectors.
16. ALC probe cable extension made from 24 inches of RG-55 A/U cable and two UG-88/U connectors.
17. Three UG-914/U connectors for use with items, 14, 15, and 16.
18. Grid-dip meter.

### 6-10. Alignment of Mixer

1. Disconnect the 900-B from its power source and remove the unit from its cabinet or rack.
2. Connect the 900-B RF OUTPUT terminal to the D-50B detector. Terminate the unused detector input with the TR-53 terminating resistor.
3. Connect the SCOPE VERT and SCOPE HORIZ terminals of the 900-B to an oscilloscope.
4. Set the 900-B BAND SELECTOR switch to UHF.
5. Set the SWEEP WIDTH switch to WIDE.
6. Adjust the SWEEP WIDTH control for maximum sweep width.
7. Tune the 900-B to a center frequency of 825 mc.
8. Apply power to the 900-B and allow 30 minutes for warm-up.
9. Adjust the ALC GAIN control, on the ALC chassis, to flatten the displayed response. Do not adjust for more ALC voltage than necessary.
10. Set the 900-B PREAMPLIFIER AC-DC switch to DC.
11. Adjust the 900-B PREAMPLIFIER GAIN and RF OUTPUT controls so as not to overload the oscilloscope preamplifier. If necessary attenuate the 900-B output signal with the built-in attenuator.
12. Adjust the oscilloscope vertical gain control for a display height of about 2 inches.
13. Set the 900-B POWER switch to OFF.
14. Remove the two screws holding the mixer on its mounting bracket.
15. Disengage the banana plug at the opposite end of the mixer by pulling the chassis straight out in a direction toward the power supply filter capacitors.
16. Support the mixer on the preamplifier chassis or on the 900-B frame structure.
17. Disconnect the cable ("red" coded) from J7 on the BAND SELECTOR switch SW5.
18. Disconnect the cable ("purple" coded) from J701 on the mixer.

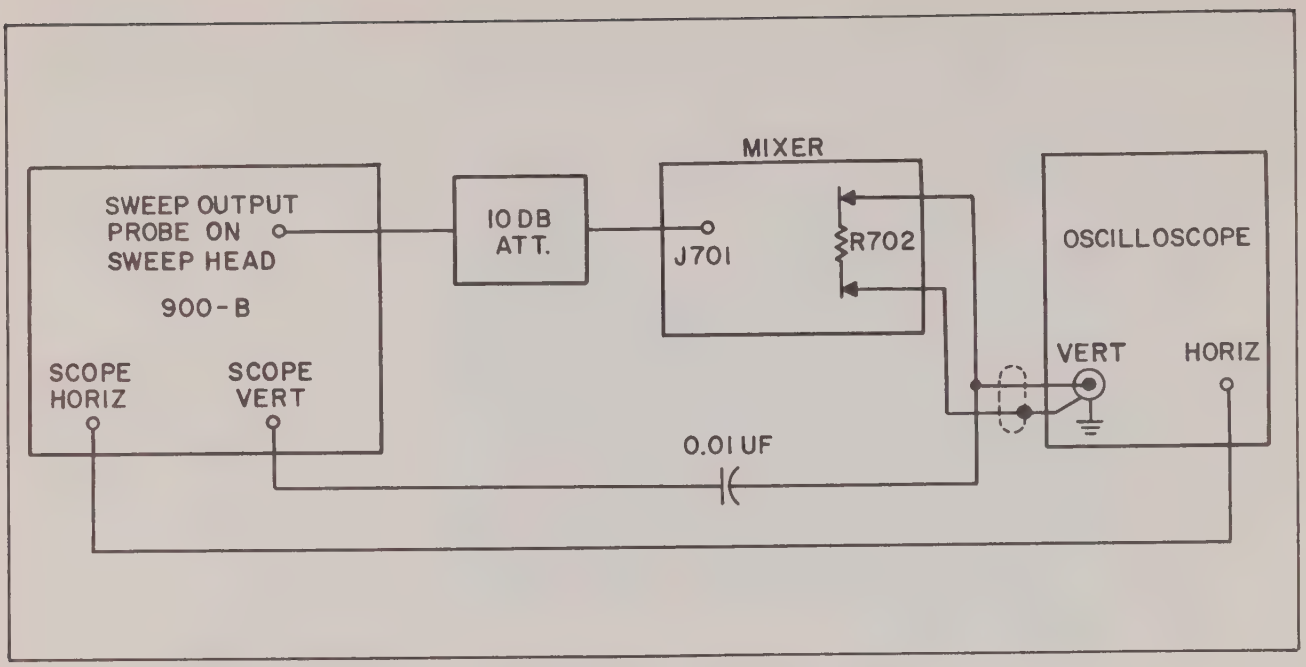



**Fig. 48—Setup for Alignment of Mixer High-Pass Filter**

19. Connect the test set-up shown in Fig. 48. The 0.01 ufd capacitor is connected from the "hot" terminal of the SCOPE VERT connector on the 900-B to the "hot" terminal of the oscilloscope's vertical input.
20. Remove the top and side mixer covers.
21. Set the 900-B POWER switch to ON.
22. Pull the 10 MC and 100 MC marker switches and adjust the amplitude of the markers.
23. The proper response of the high-pass filter circuit is shown in Fig. 49.
24. Adjust trimmer C703 (Fig. 42) to peak the response at 600 mc.
25. Adjust trimmers C701 and C702 (Fig. 42) so that the 600 mc and 1050 mc points on the response curve are at about the same level. It is important to keep these points at the top of the curve. The low frequency skirt should drop off as sharply as possible.
26. This concludes the adjustment of the high-pass filter.
27. Disconnect the cable at J701 and connect it to J702.
28. Tune the 900-B to a center frequency of 400 mc.
29. The proper response of the low-pass filter is shown in Fig. 50. Only the high end of the response is of interest for this adjustment.
30. Adjust trimmer C707 (Fig. 43) to drop the 500 mc point on the curve as low as possible.
31. Inductors L703, L704, and L706 also affect the response of the low-pass filter. A devise made from a small iron

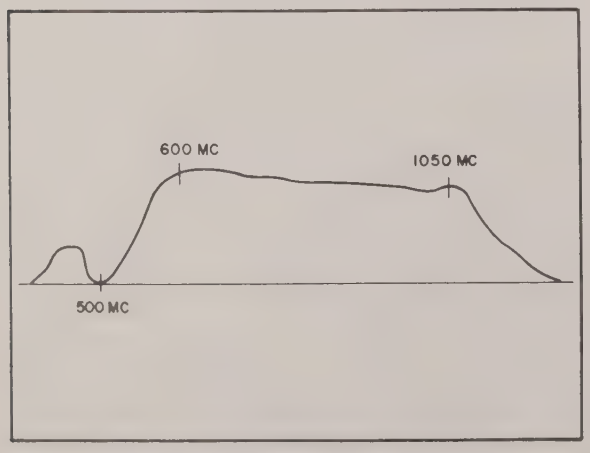



**Fig. 49—Proper Response of High-Pass Filter**

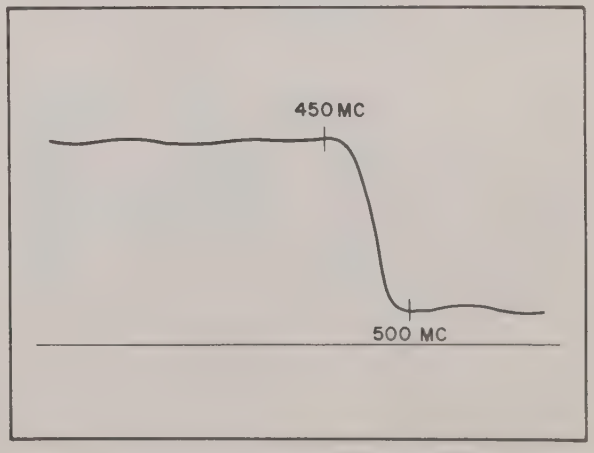



**Fig. 50—Proper Response of Low-Pass Filter**

tuning slug, a small brass tuning slug, and a tuning wand may be used for determining which, if any, of these inductors need adjustment. The device is made by attaching the iron slug to one end of the tuning wand and attaching the brass slug to the other end.

32. Slip the tuning device slugs into the center of each coil; L703 first, L704 next, and L706 last. Take care to avoid shorting the turns. If the response improves as the iron slug is inserted, increase the inductance of the coil by squeezing the turns together. If the response improves as the brass slug is inserted, decrease the inductance of the coil by separating the turns. If the response is degraded as either slug is inserted, the coil is properly tuned.

33. This concludes the adjustment of the low-pass filter.

35. Return normal connections to the mixer: "red" coded cable from the sweep head to J7 on SW5, "purple" coded cable from J8 on SW5 to J701 on the mixer, "purple" coded cable from J9 on SW5 to J702 on the mixer.

36. Push the 10 MC and 100 MC marker switches.

37. Tune the 900-B to a center frequency of 1050 mc.

38. Set the sweepwidth to 10 mc.

39. Using the bolometer, measure the output of the fixed oscillator. The reading should be about + 19 dbm.

40. Using the bolometer, measure the output of the sweep oscillator. The reading should be at least + 14 dbm.

**Note**

Readings less than those indicated in steps 39 and 40 suggest a weak oscillator tube or an improperly adjusted probe. If either reading is low, the maximum output in the VHF range will be less than the specified 0.25 v rms.

41. Connect the 900-B RF OUTPUT terminal to the D-50-B detector. Terminate the unused detector input.

42. Connect the SCOPE VERT and SCOPE HORIZ terminals on the 900-B to the oscilloscope.

43. Set the BAND SELECTOR switch to VHF.

44. Set the SWEEP WIDTH switch to WIDE.

45. Adjust the SWEEP WIDTH control for maximum sweep-width.

46. Tune the 900-B to a center frequency of 200 mc.

47. A zero beat will appear at the extreme left of the scope trace if the fixed oscillator is properly aligned.

48. Disable the ALC by turning the RF OUTPUT control fully clockwise.

49. Adjust trimmer C703 for maximum response.

50. Adjust trimmer C715 for maximum response.

51. Connect a voltmeter across R702 in the mixer.

52. Adjust the coupling loop for maximum height of the response display on the scope. Do not permit the voltage across R702 to rise above 3.5 volts during the adjustment.

53. Return the RF OUTPUT control to its initial setting.

54. Disconnect the cables to J702 on mixer chassis and the RF OUTPUT connector.

55. Arrange the test setup shown on Fig. 51.

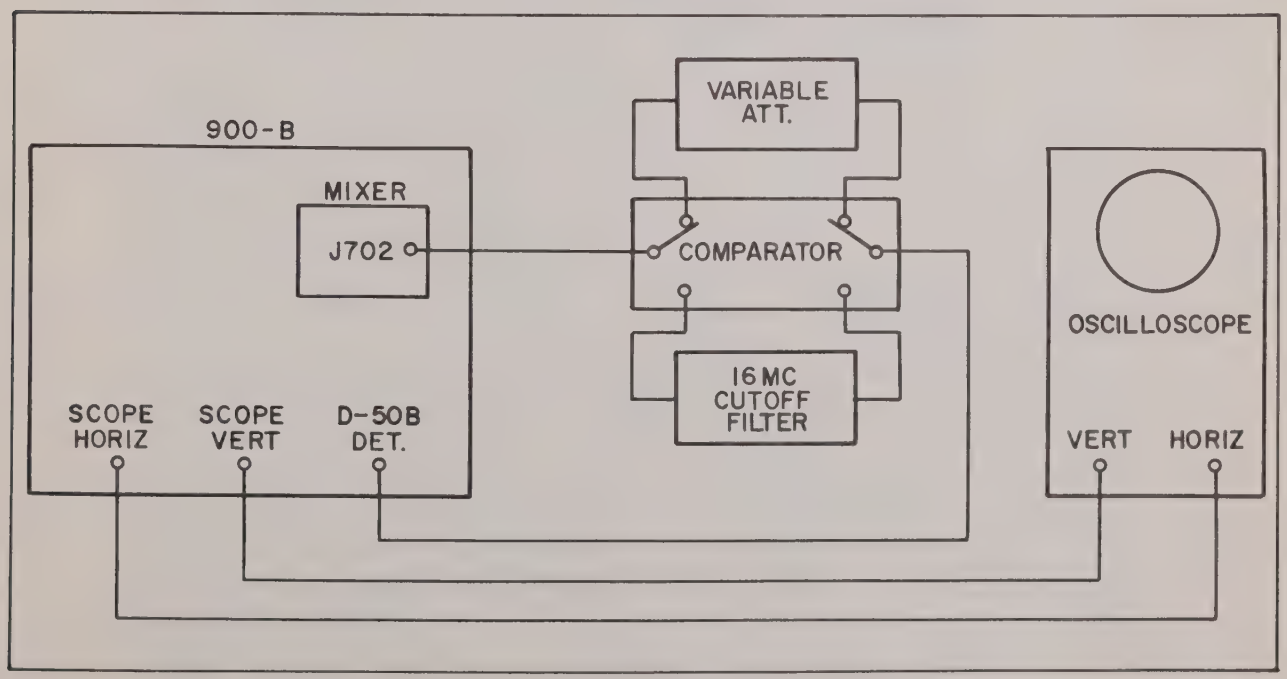



**Fig. 51—Setup for Adjustment to Eliminate Spurious Mixer Beats**

56. Pull the 100 MC marker switch and adjust the marker amplitude.

57. Set the variable attenuator for zero attenuation. A response should be obtained as shown in Fig. 52.

58. Set the variable attenuator for 30 db attenuation and increase the 900-B scope preamplifier gain to obtain a display similar to that in Fig. 53. The spurious beats appear along the base line; some peaks are above the 30 db reference line and some below. The mixer must be adjusted so that all peaks are below the 30 db line. This is accomplished by one or more of the adjustments in steps 59, 60 and 61. **Do not make more than slight adjustments. Over-adjustment will spoil the alignment work already done.**

59. Tickle the coupling loop to obtain very slight movement. Do not move the loop from the set position.

60. Adjust C707. Not more than one complete turn of the adjustment screw is permissible.

61. Adjust C715 **slightly.**

62. This concludes the adjustment for spurious beats.

63. Substitute the 15 mc bandpass filter for the 16 mc filter in the test setup.

64. A display should appear as shown in Fig. 54. If the harmonics are not well down, reposition the coupling loop **slightly** to bring them down.

65. This concludes mixer alignment.

66. Disconnect the 900-B from the test set-up and reconnect the cable from J9 on the BAND SELECTOR switch to J702 on the mixer.

67. Return the top and side covers to the mixer chassis and fasten them.

68. Insert the banana plug on the mixer chassis into its receptacle and fasten the chassis to its mounting bracket.

### 6-11. Alignment of Fixed Oscillator

**Note**

Alignment of the fixed oscillator can be accomplished only if the mixer is properly aligned. If alignment is performed after replacement of V201, the first 2 steps are already complete.

1. Disconnect the 900-B from its power source and remove the unit from its cabinet or rack.
2. Disconnect the B+ lead at filter barrel FB202.
3. Connect a dc milliammeter (0-100 ma) between the B+ lead and FB202.
4. Connect the 900-B sweep output to the D-50B detector. Terminate the unused detector input with the TR-53 termination.

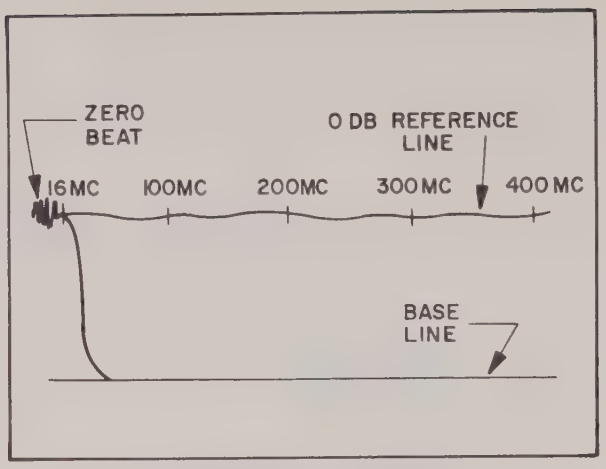



Fig. 52—Response of 18 mc Filter with No Reference Attenuation

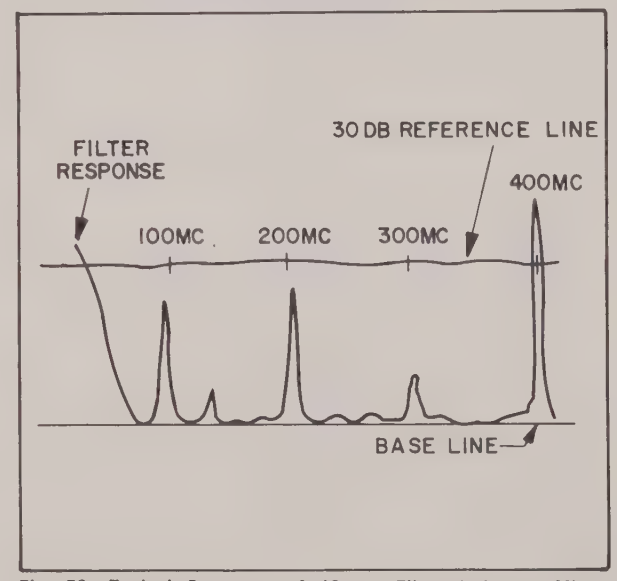



Fig. 53—Typical Response of 16 mc Filter (prior to Mixer Balancing) with 30 db Reference Attenuation

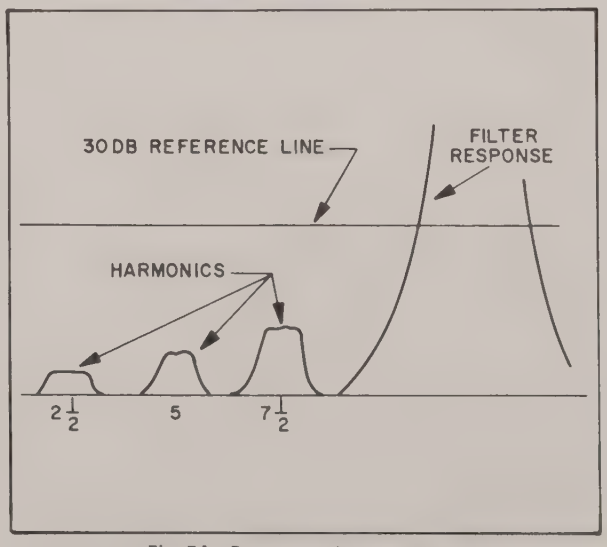



Fig. 54—Response of 15 mc Filter

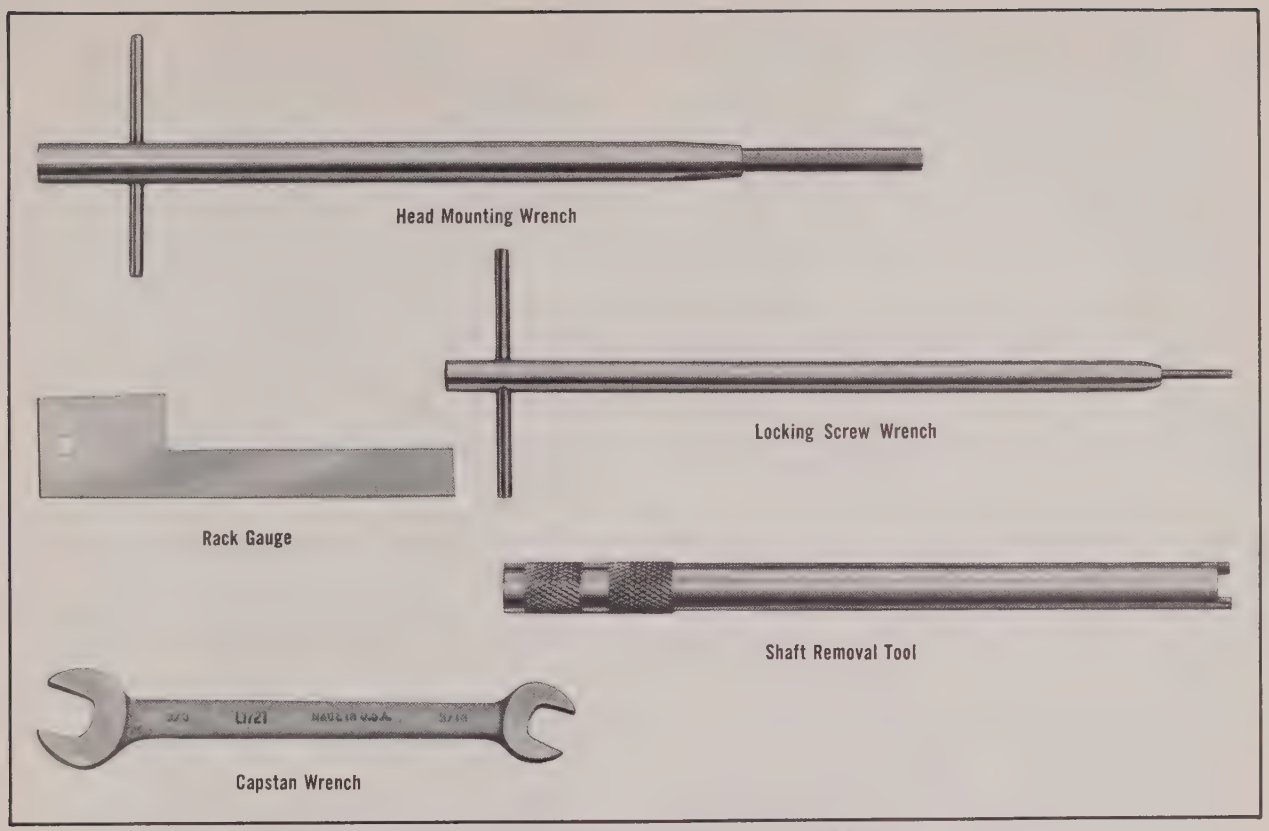



Fig. 55—Tools Required for Calibration of Tuning Dial

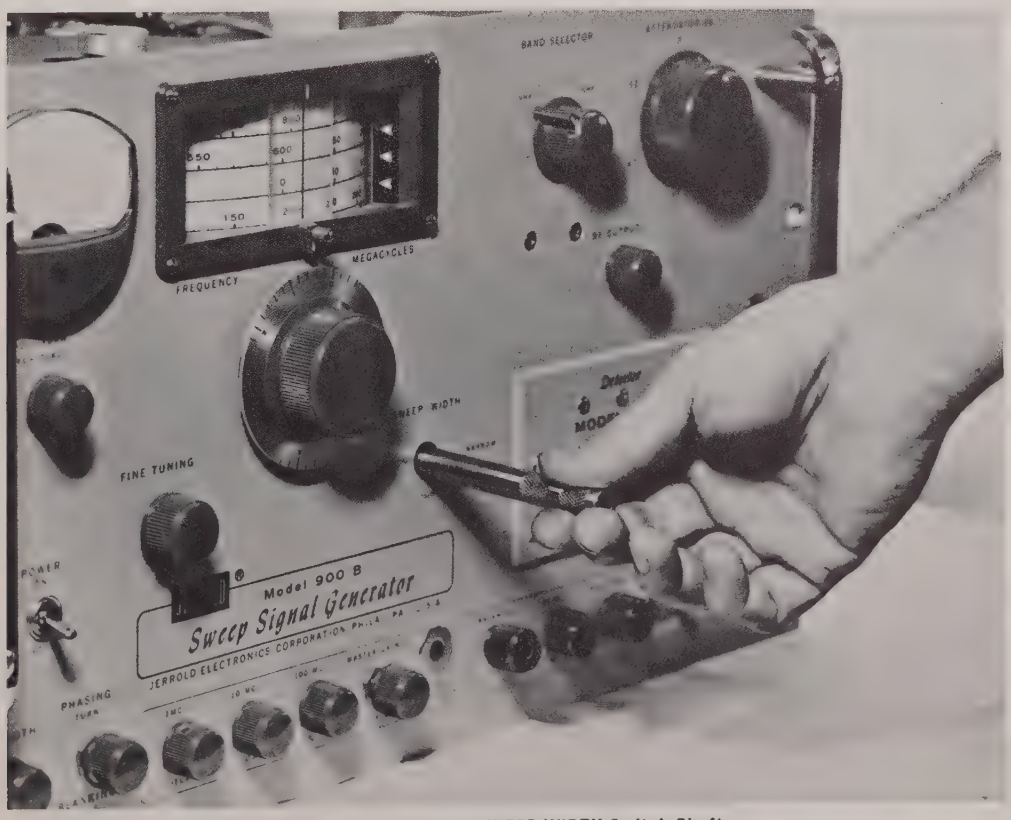



Fig. 56—Removing SWEEP WIDTH Switch Shaft

5. Connect the SCOPE VERT and SCOPE HORIZ terminals of the 900-B to the oscilloscope.
6. Set the BAND SELECTOR switch to VHF.
7. Pull the 100MC marker switch and adjust marker amplitude.
8. Apply power to the 900-B.
9. If the milliammeter reads more than 20 ma, the circuit is not oscillating. In that case, adjust the CATHODE TUNING trimmer on the oscillator chassis for a reading of from 8 to 12 ma.
10. Allow 30 minutes for warm-up before proceeding.
11. Adjust the FREQUENCY MEGACYCLES control to obtain a zero beat display on the oscilloscope.
12. Set the SWEEP WIDTH control for a sweepwidth of about 3 mc.
13. With the FIXED OSCILLATOR FREQUENCY control (accessible through the front panel) at mid-range, adjust the PLATE TUNING trimmer until the zero beat is positioned slightly off the center of the marker.
14. Check the range of the FIXED OSCILLATOR FREQUENCY control. This control should be capable of causing the zero beat to move from one extreme of the scope display to the other, indicating a range of 3 mc.
15. Return the zero beat to the position set in step 13 using the FIXED OSCILLATOR FREQUENCY control.
16. Adjust the CATHODE TUNING trimmer for minimum indication on the milliammeter. Then repeat step 13 and recheck the setting of the CATHODE TUNING trimmer.

### 6-12. Adjustment of Feedback Tab on UHF Oscillator

1. Plug the 900-B line cord into an appropriate power outlet. Set the POWER switch to ON and allow 30 minutes for warm-up.
2. Connect the RF OUTPUT terminal to the D-50B detector; terminate the unused detector input with the TR-53 termination.
3. Connect the SCOPE VERT and SCOPE HORIZ terminals to the oscilloscope.
4. Set the BAND SELECTOR switch to UHF.
5. Set the SWEEP WIDTH switch to WIDE and adjust the SWEEP WIDTH control for maximum sweepwidth.
6. Pull the 10MC and 100MC marker switches and adjust the amplitude of the markers.
7. Adjust the ATTENUATOR switch and the RF OUTPUT control for best oscilloscope display.
8. Tune the 900-B to display the high-frequency end of the 900-B spectrum.
9. Using a small diameter, non-metallic rod, adjust the position of the feedback tab forward and away form the plate end of the tube until the response at 1250 mc is a maximum. Note the response level at this frequency.
10. Tune the 900-B to display the low-frequency end of the 900-B spectrum.
11. Adjust the position of the feedback tab so that the response level at 450 mc is as close as possible to that noted in step 9 for 1250 mc.
12. Tune back and forth between the high end and the low end, adjusting the feedback tab until the 450 and 1250 mc points are at the same level.

### 6-13. Calibration of Output Meter

1. Raise the 900-B cabinet cover or remove the unit from its rack.
2. Plug the line cord into an appropriate power outlet and set the POWER switch to ON. Allow 30 minutes for warm-up.
3. Set the BAND SELECTOR switch to VHF.
4. Set the SWEEP WIDTH switch to NARROW and adjust the SWEEP WIDTH control for minimum sweepwidth.
5. Tune the 900-B to a center frequency of 50 mc.
6. Set the ATTENUATOR swich to 0.
7. Push the BLANKING switch.
8. Zero the 900-B output meter with the meter control.
9. Connect the bolometer to the RF OUTPUT terminal.
10. Adjust the RF OUTPUT control for a reading of —1 dbm on the bolometer.
11. Adjust the VHF METER CALIBRATE control on the ALC chassis, for a reading of 0.2 volt on the VHF scale of the 900-B output meter.
12. Set the BAND SELECTOR switch to UHF.
13. Tune the 900-B to a center frequency of 400 mc.
14. Set the ATTENUATOR switch to 10.
15. Adjust the RF OUTPUT control for a 1-volt reading on the UHF scale of the 900-B output meter.
16. Adjust the UHF METER CALIBRATE control, on the ALC chassis, for a reading of +3 dbm.

### 6-14. Alignment of Harmonic Marker Generator

1. The 900-B chassis need not be removed from its cabinet for this alignment procedure; however, if the unit is rack mounted, it should be taken from its rack.

**Note**

Steps 2 through 5 need not be performed unless the marker generator is far out of alignment.

2. Remove the four screws holding the marker chassis and stand the chassis on its end.
3. Turn all tuning slugs in until they resist further turning. Do not force the slugs past this point.
4. Adjust the split rings on L406 and L410 for minimum coupling.
5. Using a grid dip meter, tune L401 and L402 to 5.1 mc; L406, L407, and L408 to 10 mc; L410 and L411 to 50 mc; L412 and L413 to 100 mc.
6. Connect the 900-B RF OUTPUT terminal to one input of the D-50B detector; terminate the unused detector input with the TR-53 termination.
7. Connect the SCOPE VERT and SCOPE HORIZ terminals to an oscilloscope.
8. Apply power and allow 30 minutes for warm-up.
9. Set the oscilloscope vertical sensitivity to 100 mv/cm.
10. Pull the 900-B BLANKING switch.
11. Set the BAND SELECTOR switch to UHF.
12. Set the PREAMPLIFIER GAIN control fully counterclockwise.
13. Set the RF OUTPUT control for a display height of between 4 and 5 cm; add attenuation, if necessary.
14. Connect a VTVM to TEST POINT 10 MC.
15. Tune L401 for maximum indication on the VTVM.
16. Tune L402 for minimum indication on the VTVM.
17. Tune L406 and L407 for maximum indication on the VTVM.
18. Pull the 1 MC and 10 MC marker switches and adjust marker amplitude.
19. With a sweep width of about 11 mc, tune the 900-B so that any two 10 mc markers can be seen.
20. Adjust the 1 MC potentiometer, on the marker chassis, so that nine 1 mc markers appear between the two 10 mc markers. Rotate the 1 MC potentiometer clockwise and counterclockwise, noting the points where the 1 mc oscillator pulls out of sync. Set the 1 MC potentiometer midway between these points.
21. Connect the VTVM to TEST POINT 100 MC.
22. Tune L408 and L410 through L413 for maximum indication on the VTVM. These adjustments interact so that it will be necessary to tune each coil several times to obtain maximum indication.
23. Push the 1 MC marker switch.
24. Tune the 900-B to the highest center frequency with a sweep width of about 200 mc.
25. Readjust L407 **slightly** for maximum height of the 10 mc marker.
26. Turn on the markers one at a time and adjust trimmers C410 (for 1 mc markers), C415 (for 10 mc markers), and C343 (for 100 mc markers) so that the amplitude of the markers in each group is the same at 400 mc and 900 mc.

    Tune to the highest center frequency after each adjustment to see that the markers are not lost there.
27. Tune the 900-B to a center frequency of 350 mc, and adjust the SWEEP WIDTH control for 100 mc sweep width.
28. Pull all marker switches.
29. Turn the 10 MC marker control fully clockwise, and adjust the MASTER marker control so that the 10 mc markers are 1 cm high on the oscilloscope display.
30. Adjust the 1 MC marker control so that the 1 mc markers are 0.5 cm high.
31. Adjust the 100 MC marker control so that 100 mc markers are 2 cm high.
32. Tune the 900-B center frequency up and down, making small adjustments of the 1 MC potentiometer, L407, and L413, until this size relationship is maintained without loss of the 10 and 100 mc markers up to about 900 or 950 mc and without loosing the ability to obtain these markers at the highest frequency by adjusting the MASTER marker control only.

### 6-15. Calibration of Tuning Dial

6-16. GENERAL

After long use, the diaphragm of the wobbulator will soften and relax, causing a noticeable discrepancy in the calibration of the tuning dial, especially in the wide sweep mode. Factors which may affect calibration for both wide and narrow sweep operation include replacement of the sweep oscillator tube, V601, adjustment of the feedback tab on this tube, and adjustment of any of the three probes on the sweep head.

Slight calibration errors can be compensated for by adjusting the tuning dial cursor. If the error is too great to be compensated for in this manner, the dial must be recalibrated. Since the calibration procedure is complex and requires special skills and tools, it is recommended that the instrument be returned to Jerrold for this work. However, for skilled technicians equipped with the proper tools, the complete procedure is given in the following paragraphs.

Note that if the sweep oscillator tube (V601) is weak or defective, it will be impossible to calibrate the instrument. This condition is indicated when the tube draws more than 200 ma of plate current and by response drop-off at the higher frequencies.

6-17. DETERMINING THE CALIBRATION NECESSARY

1. Connect the RF OUTPUT terminal to an input of the D-50B detector.

2. Connect the SCOPE VERT and SCOPE HORIZ terminals to an oscilloscope.
3. Apply power and allow 30 minutes for warm-up.
4. Using the internal markers, check the calibration for both VHF and UHF narrow sweep operation.
5. If the narrow sweep scales are adequately calibrated, it will only be necessary to perform the wide sweep calibration procedure in paragraph 6-20. If they are not, complete the narrow sweep calibration procedure (paragraph 6-19). In either case, the preliminary steps described in paragraph 6-18 must be performed first.

6-18. PRELIMINARY STEPS

1. Remove the 900-B chassis from its cabinet or rack.
2. Unplug P15 (Fig. 66).
3. Unplug P1 (Fig. 66).
4. Disconnect the "red" and "purple" coded cables at P7, P8, and P9 of the BAND SELECTOR switch.

**CAUTION**

DO NOT DISCONNECT THE COUPLING PROBES AT THE SWEEP HEAD.

5. Remove the FREQUENCY MEGACYCLES control knob.
6. Remove the SWEEP WIDTH switch knob.
7. Slide the switch shaft removal tool (Fig. 55) over the shaft of the SWEEP WIDTH switch and engage the shaft locking nut (Fig. 56). Turn the tool counterclockwise until the shaft is freed; remove the shaft.
8. Stand the chassis on its side (power transformer down).
9. Using the sweep head mounting screw wrench, remove the two screws that fasten the sweephead to the rubber shock obsorbers. These screws are on either side of the 115V-230V switch (Fig. 67).
10. Return the chassis to its normal position.
11. Support the sweep head at the probe end and remove the two caphead screws holding the head to the mounting bracket (Fig. 66).
12. Carefully maneuver the sweep head out of the chassis (Fig. 57). Disconnect all cables that interfere with this operation—be certain to correctly reconnect these cables afterward.
13. Remove the wobbulator motor housing (Figs. 63 and 64).

**CAUTION**

DO NOT REST THE SWEEP HEAD ON THE WOBBULATOR MOTOR.

14. Install the sweep head in an alignment jig (Fig. 58).
15. Use extension cables for connecting the power and probe cables to the sweep head.

**Note**

The extension cables produce a mis-match which affects the flatness of the responsive curve but not the calibration.

16. Replace the SWEEP WIDTH switch shaft and knob.
17. Replace the FREQUENCY MEGACYCLES knob.

6-19. NARROW SWEEP CALIBRATION

1. Connect the RF OUTPUT terminal to one input of the D-50B detector. Terminate the unused detector input with the TR-53 termination.
2. Connect the SCOPE VERT and SCOPE HORIZ terminals to the oscilloscope.
3. Connect the 900-B line cord to an appropriate power outlet and set the POWER switch to ON. Allow 30 minutes for warm-up.
4. Set the BAND SELECTOR switch to UHF.
5. Set the SWEEP WIDTH switch to WIDE.
6. Set the SWEEP WIDTH control fully clockwise, or just below the point where the wobbulator chatters.
7. Pull the 100 MC marker switch and adjust marker amplitude.
8. Tune the 900-B to display the highest frequencies; i.e., 800 to 1200 mc.
9. Remove the end cover from the sweep oscillator housing to expose the feedback tab.
10. Using a small diameter, non-metallic rod, position the feedback tab to obtain maximum amplitude on the oscilloscope display. Note the height of the display at 1200 mc.
11. Tune the 900-B so that the response of the lowest UHF wide sweep frequency can be observed. If the height of the display at this frequency is appreciably lower than the height at 1200 mc (noted in step 10), position the feedback tab closer to the plate end of V601 to obtain more feedback. The final position of the tab will be that which favors the high frequencies as much as possible and yet permits the minimum output specification of at least 0.5 volts over the entire frequency range to be met.
12. Pull the BLANKING switch.
13. Turn the ALC "off" by turning the RF OUTPUT control fully clockwise.
14. Tune the 900-B to display the 800-1200 mc response.
15. Loosen the locking nut on the r-f probe (Fig. 63) and screw the probe in until the response drops off. Then screw the probe out just far enough to return the response to its initial level. Tighten the locking nut.

16. Loosen the locking nut on the ALC probe (Fig.63) and screw the probe in until the response drops off. Then screw the probe out just far enough to return the response to its former level. Tighten the locking nut.

17. Tune the 900-B to 400 mc.

18. Set the SWEEP WIDTH switch to NARROW.

19. Connect the harmonic marker cable on the sweephead (Fig. 63) to the bolometer.

20. Loosen the locking nut on the marker probe and adjust the probe for a reading of +3 dbm on the bolometer. Tighten the locking nut, disconnect the bolometer, and reconnect the marker cable to the marker generator.

21. Set the SWEEP WIDTH control for about 1 mc sweepwidth.

22. Push the BLANKING switch.

23. Zero the 900-B output meter.

24. Adjust the RF OUTPUT control for a reading of 1 volt on the UHF scale of the meter.

25. Connect the bolometer to the RF OUTPUT terminal through a 5 db attenuator.

26. The bolometer reading should be +3 dbm. If the reading is more or less than this, loosen the locknut on the ALC probe and screw the probe in or out, respectively, until the proper reading is obtained. Tighten the locknut.

27. Reconnect the detector to the RF OUTPUT terminal.

28. Twist the rack dust cover counterclockwise to disengage the bayonet-type lock and ease the cover off the rack (Fig. 59).

29. Position the rack setting gauge as shown in Fig. 60; the gauge is placed against the shaft between the two pinion gears.

30. Adjust the FREQUENCY MEGACYCLES control until the measured rack length corresponds to the gauge length.

31. Set the tuning dial cursor so that the indicator line mates with the white line scribed above the cursor.

32. If the dial reads 600 mc proceed to step 35. If not, proceed to step 33.

33. Loosen the two sets screws on the tuning dial (Fig. 61), and turn the dial drum until the 600 mc mark on the UHF narrow sweep range lines up with the cursor line.

34. Tighten the two set screws and check the rack position with the gauge to see that it did not shift.

35. Adjust the SWEEP WIDTH control for about 500 kc sweepwidth.

36. Tune the 900-B so that the 600 mc marker appears in the center of the oscilloscope display.

37. Note the tuning dial reading. If it is 600 mc proceed to step 42. If it is below 600 mc, set the dial to 600 and proceed to step 38. If it is above 600 mc, set the dial to 600 and proceed to step 40.

38. Screw the r-f probe slightly in until the marker is centered on the display. Make this adjustment in increments of ¼ turn. Do not exceed one full turn.

39. Repeat steps 16 and 21 through 27, then proceed to step 42.

40. Screw the r-f probe slightly out until the marker is centered on the display. Make this adjustment in increments of ¼ turn. Do not exceed one full turn.

41. Repeat steps 16 and 21 through 27, then proceed to step 42.

42. Tune the 900-B, so that the 700 mc marker appears in the center of the display. Repeat this process at 800, 900, 1000, 1100, and 1200 mc. If the total of all errors noted does not exceed one scale division at 1200 mc, calibration is complete for narrow band sweep; proceed to step 46. If the noted errors are greater than one scale division at 1200 mc proceed to step 43. Occasionally the dial will track properly while the calibration is off by a small amount at all frequencies. In this event proceed to step 45.

43. Tune the 900-B so that the 600 mc marker appears in the center of the display.

44. Loosen the two set screws on the tuning dial (Fig. 61). Turn the dial drum, by an amount equal to the error observed in step 42, so that the indicator line is above or below the 600 mc mark, depending on the direction of the error. Tighten the set screws. If the dial drum was set below the 600 mc mark, repeat steps 38 and 39, then proceed to step 46. If the dial drum was set above the 600 mc mark, repeat steps 40 and 41, then proceed to step 46.

45. Loosen the knurled nut on the top of the dial drum to release the tension on the dial card, and turn the card to compensate for the error. The keyway on the drum limits the amount of possible adjustment. Tighten the knurled nut.

46. Set the SWEEP WIDTH switch to WIDE and check the calibration as in step 42. If the calibration is acceptable, the procedure is complete. If not, the wobbulator motor must be repositioned to increase or decrease the capacitance depending on the direction of the error (see paragraph 6-20).

**6-20.** WIDE SWEEP CALIBRATION

Normally, calibration error in the wide sweep mode is caused by softening of the wobbulator suspension which makes the dial reading lower than the actual sweep oscillator frequency. For this condition the movable plates of the wobbulator capacitor have to be moved closer to the fixed plates.

The wobbulator motor is mounted on three supports, called capstans, which are threaded into a cast-metal plate (Fig. 62). Their adjustment is held by three locking screws. The mounts are adjusted with an open-end wrench after the locking screws have been loosened with the locking screw Allen wrench.

1. Complete steps 1 through 5 of paragraph 6-19.
2. Tune the 900-B to a center frequency of 600 mc.
3. Pull the 100 MC marker switch and adjust marker amplitude.
4. Adjust the SWEEP WIDTH control for a sweep width of 10 mc.
5. Loosen **one** locking screw at a time.
6. Turn the capstan **one** flat clockwise and tighten the locking screw.
7. Repeat steps 5 and 6 for the other capstans.
8. Loosen the locking screw on the pivot capstan (Fig. 62).
9. Turn the pivot capstan in the direction which causes the 600 mc marker to move left. Keep turning the capstan in this direction until the marker is as far left as possible; past this point the marker will begin to move right. Follow the capstan adjustment with the locking screw to be sure that the wobbulator motor is following the capstan.
10. Tighten the locking screw.
11. Set the sweepwidth to 500 kc and check the calibration as in paragraph 6-19. If the calibration is acceptable, the procedure is complete. If not, repeat steps 5 through 10 until it is.

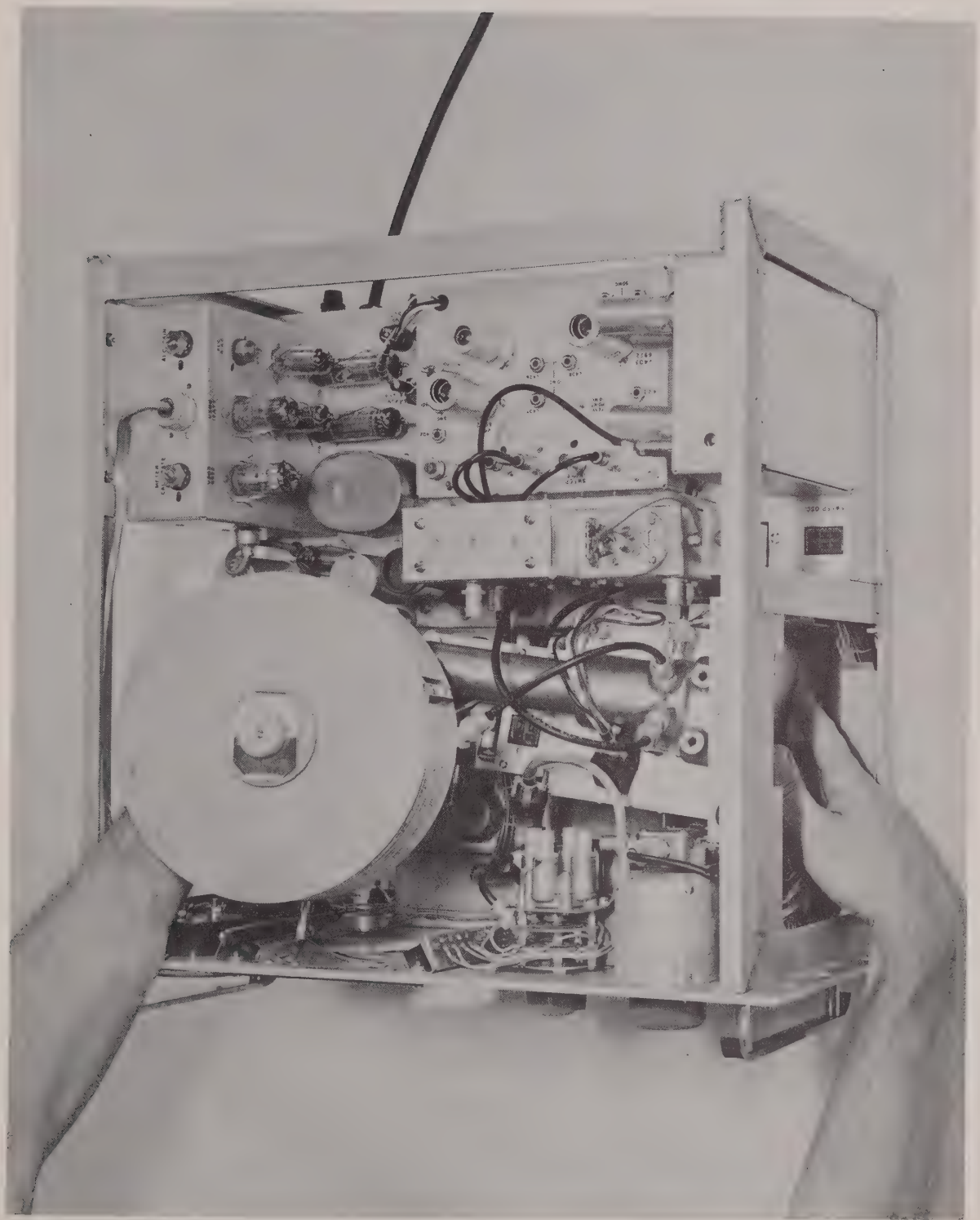


Fig. 57—Removing the Sweep Head

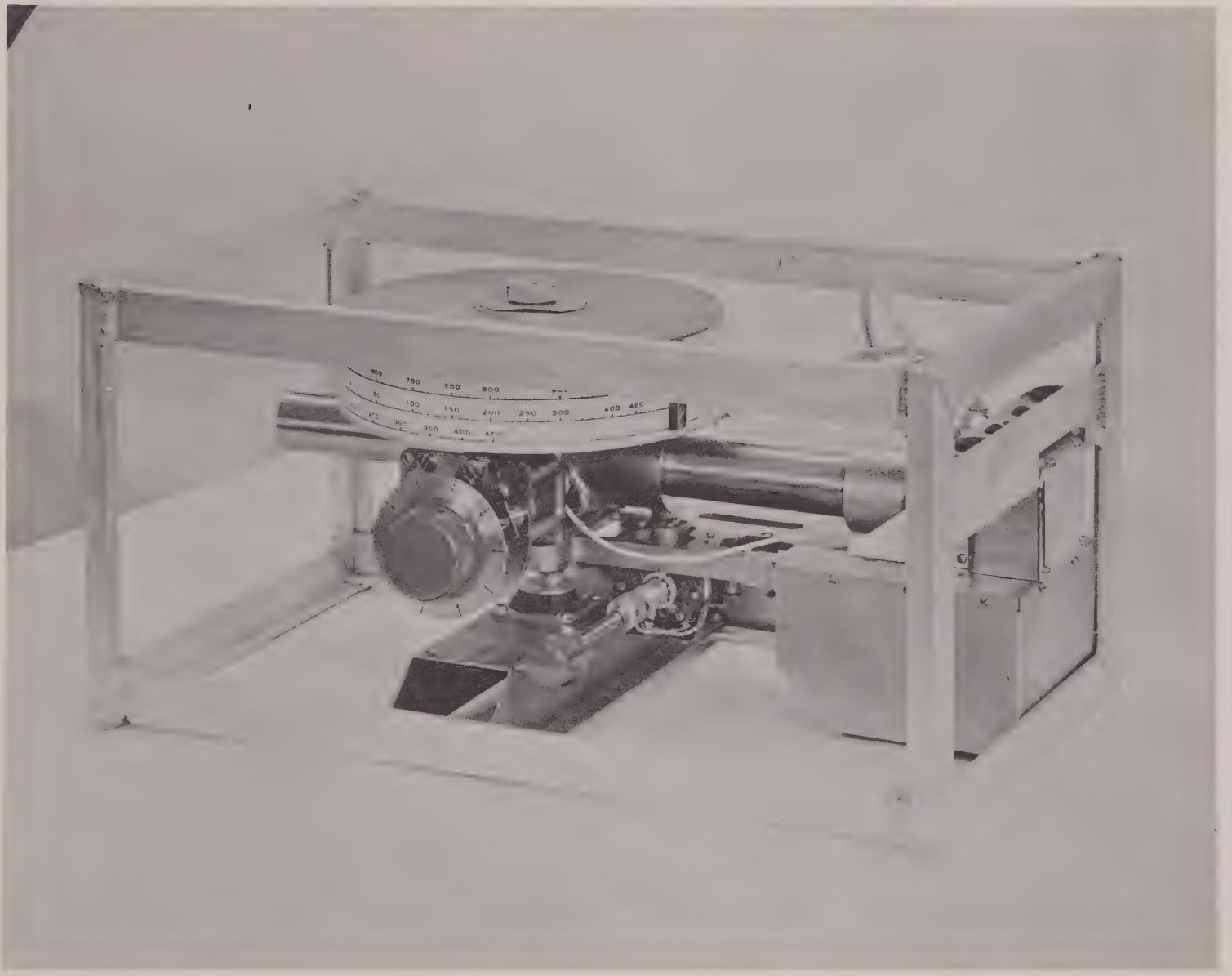


Fig. 58—Sweep Head Installed in Alignment Jig

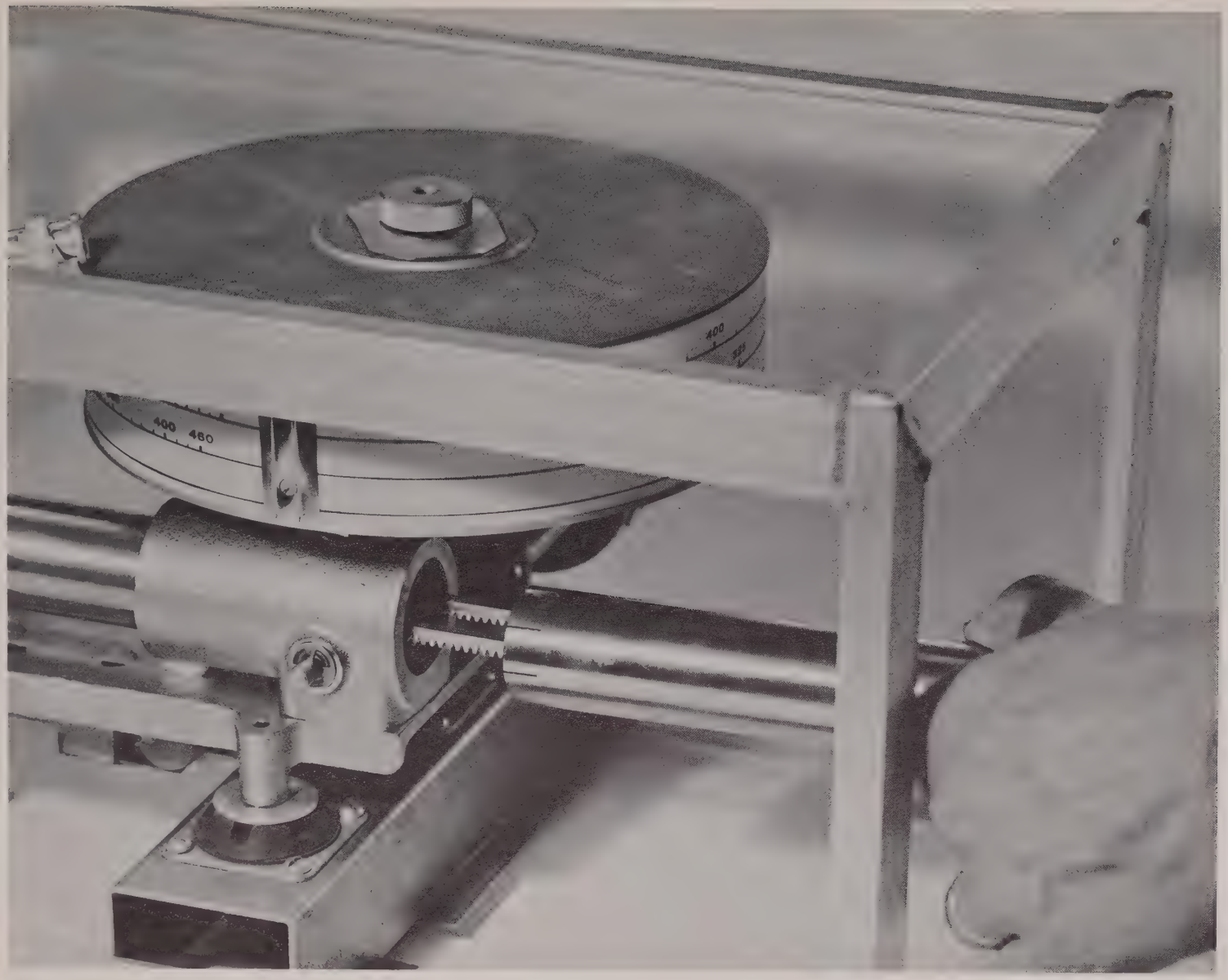



Fig. 59—Removing Rack Cover

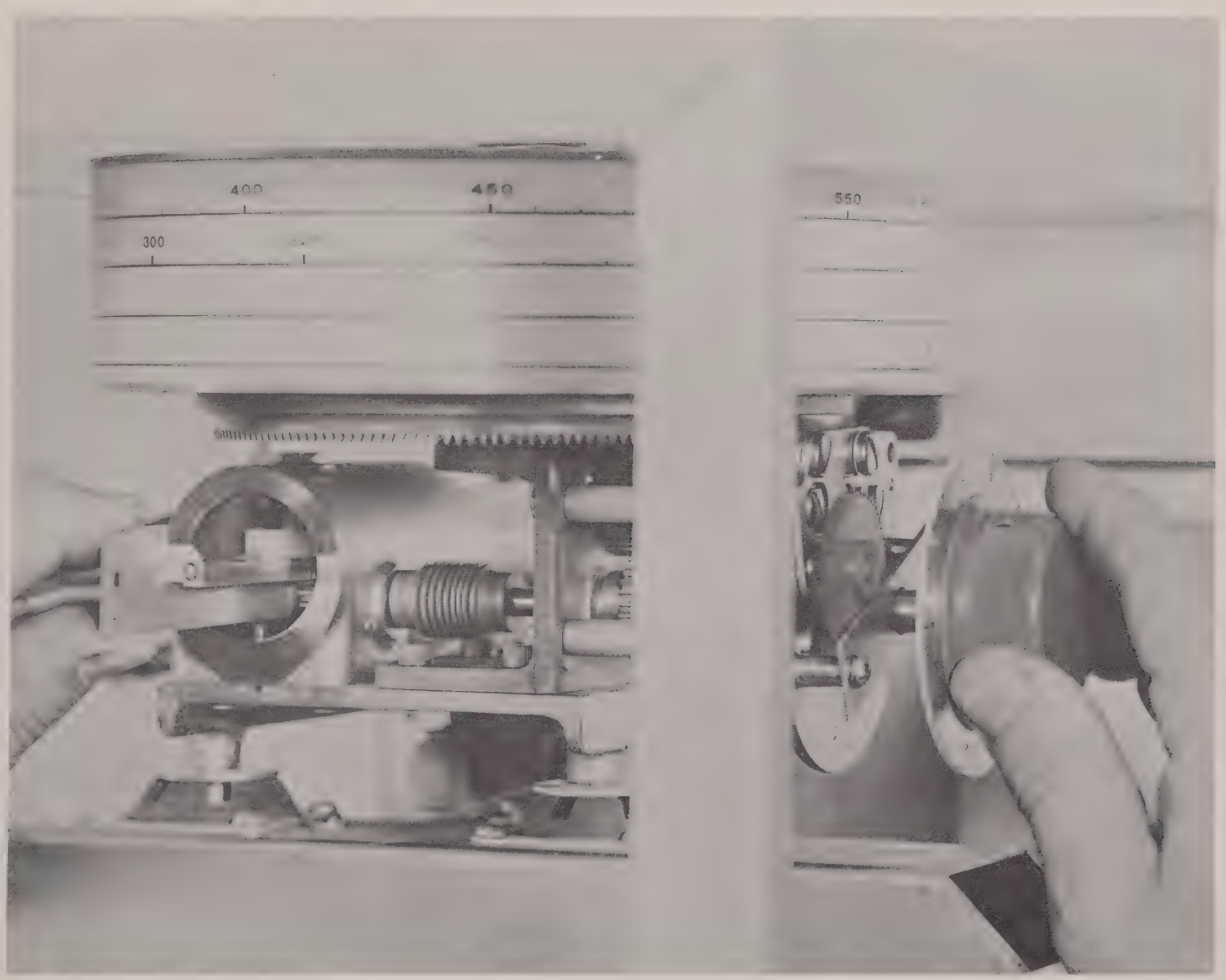



Fig. 60—Setting Position of Rack with Rack Guage

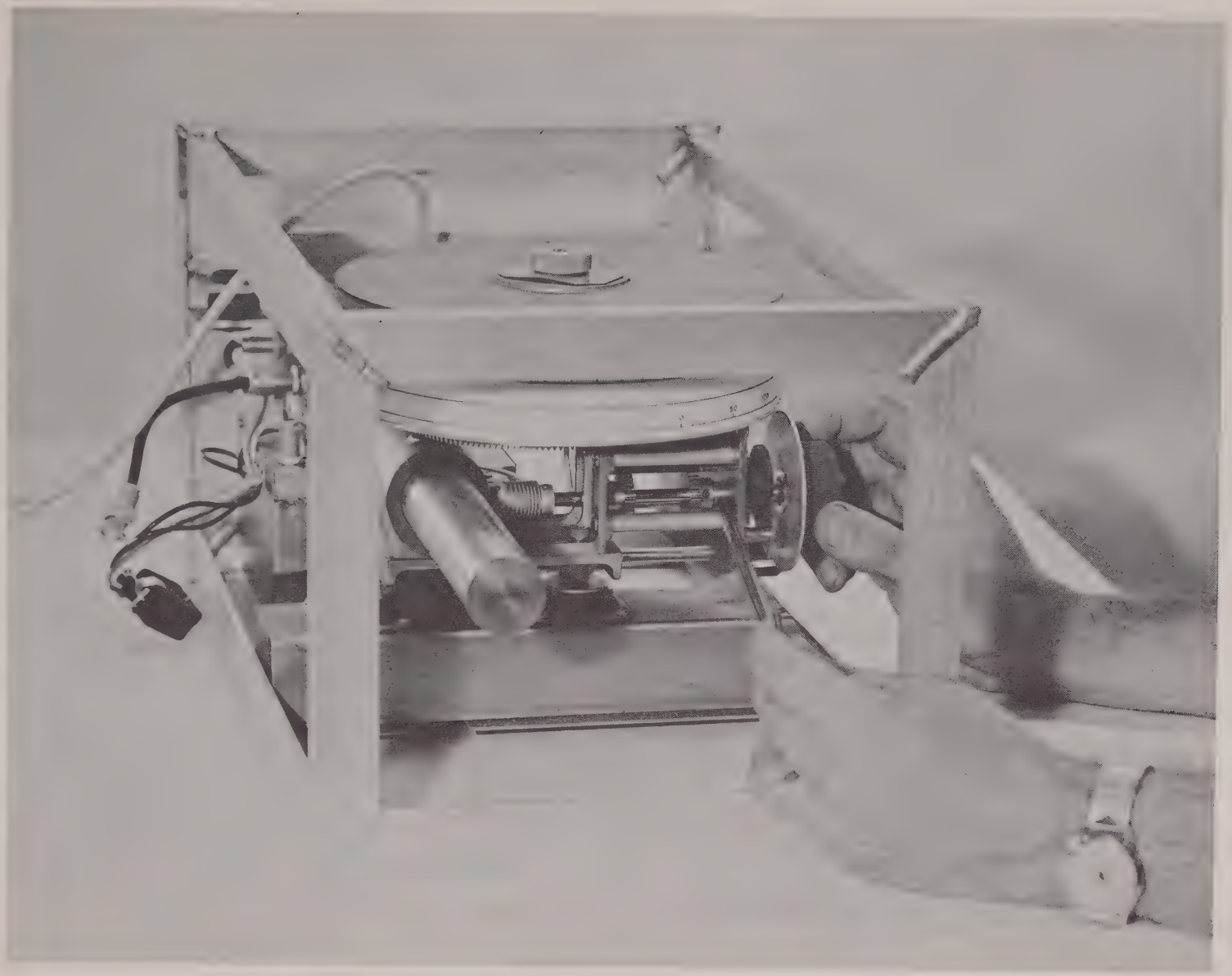


Fig. 61—Loosening Set Screw on Dial Gear

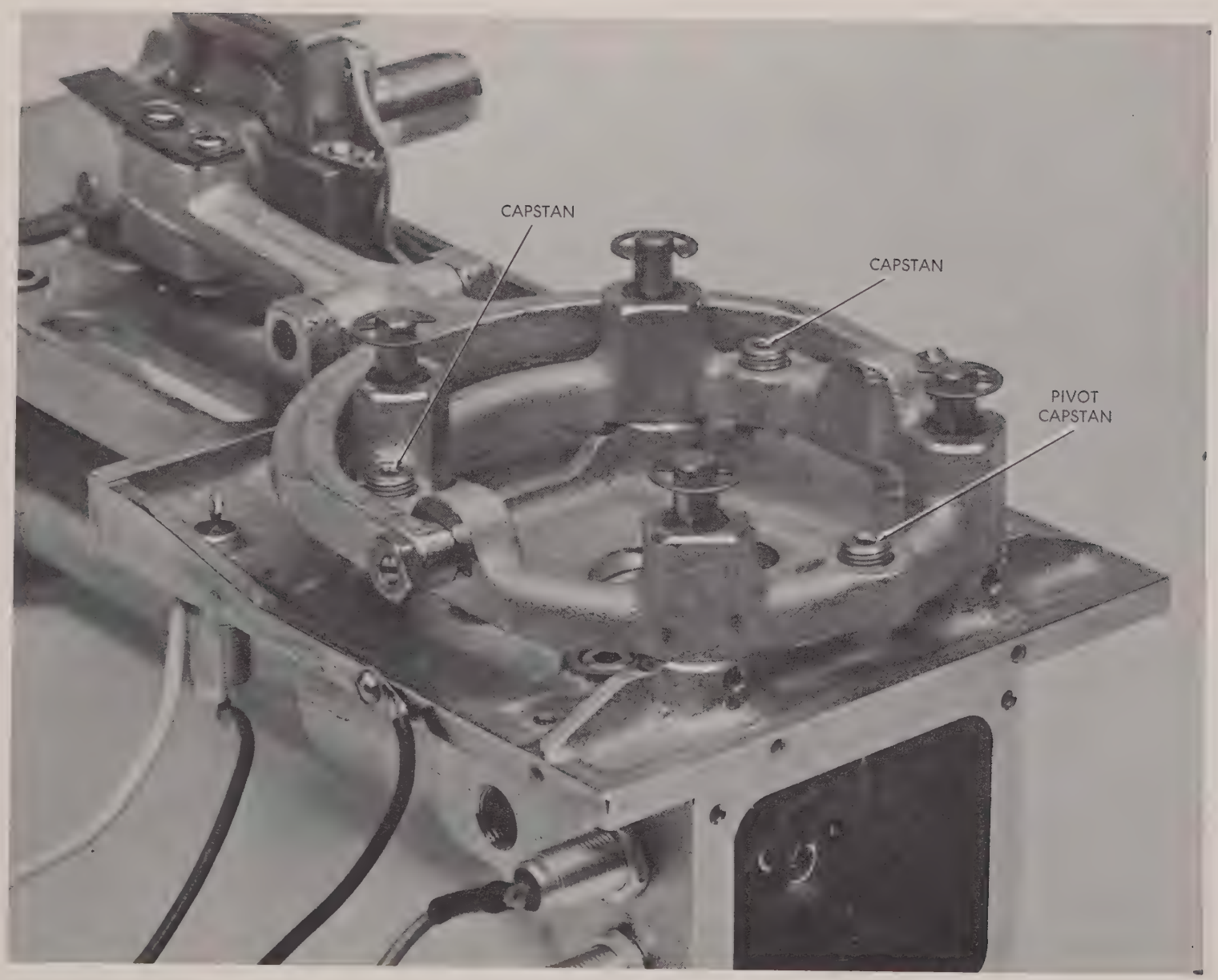



Fig. 62—Wobbulator Motor Mounting Ring

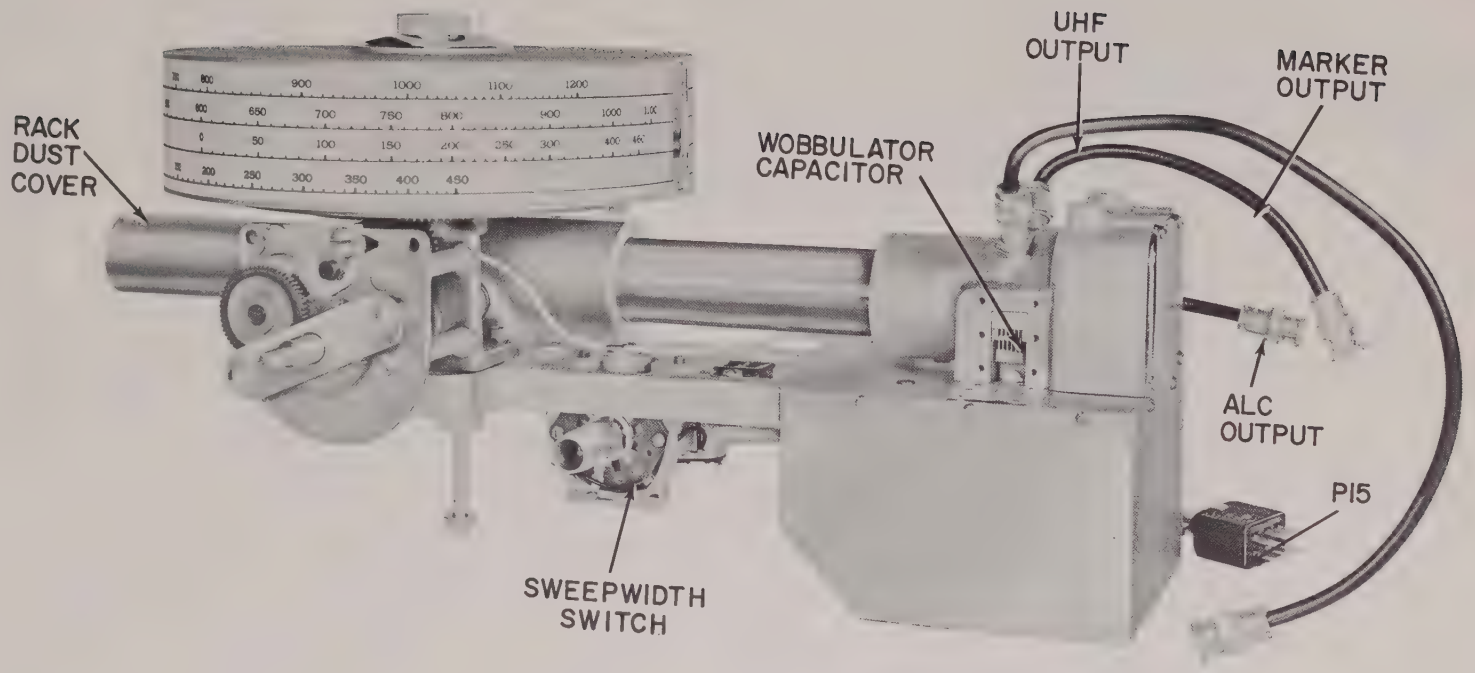



Fig. 63—Sweep Head with Wobbulator Capacitor Cover Removed and Capacitor Plates Meshed

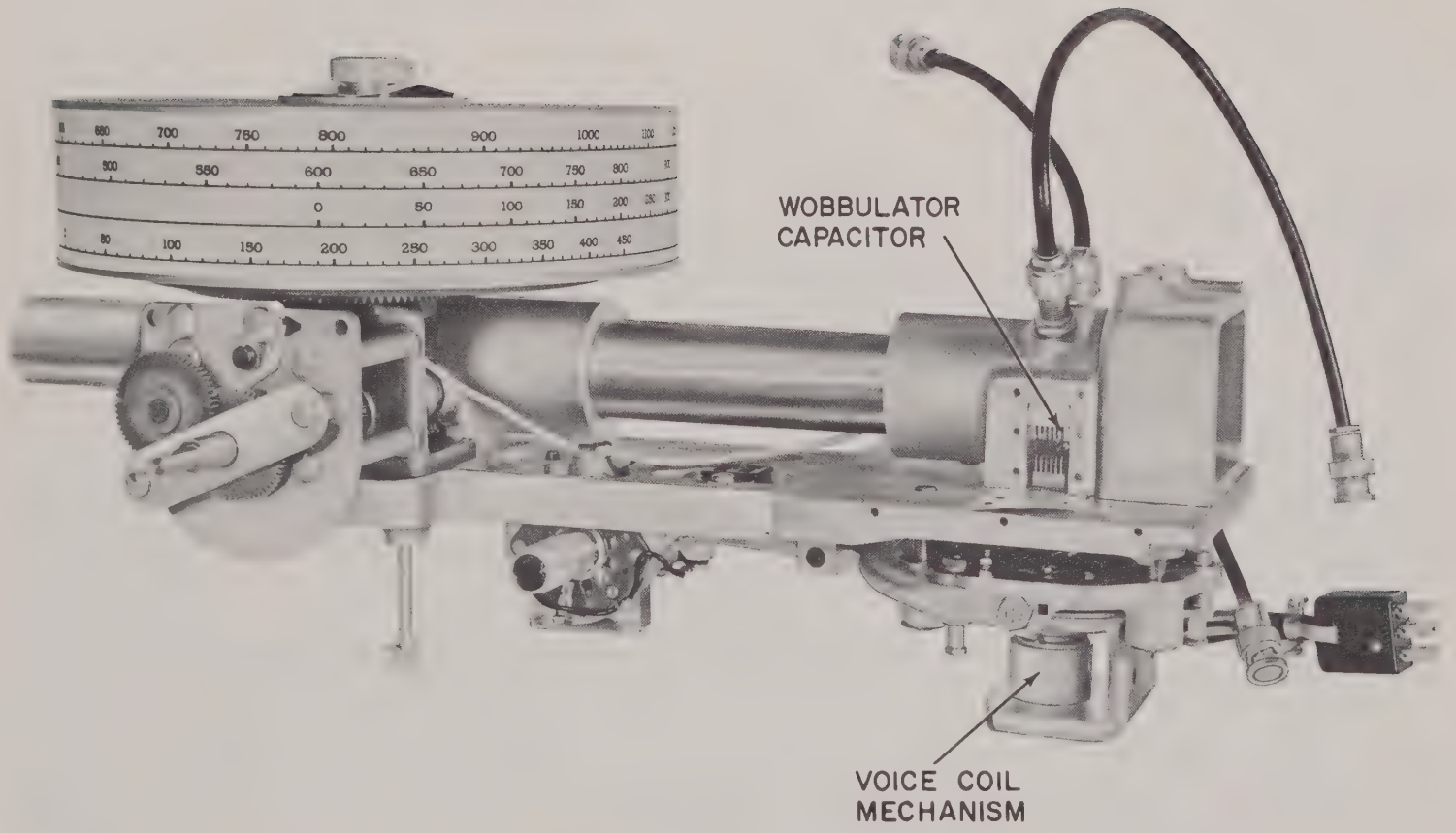



Fig. 64—Sweep Head with All Covers Removed and Wobbulator Capacitor Plates Unmeshed

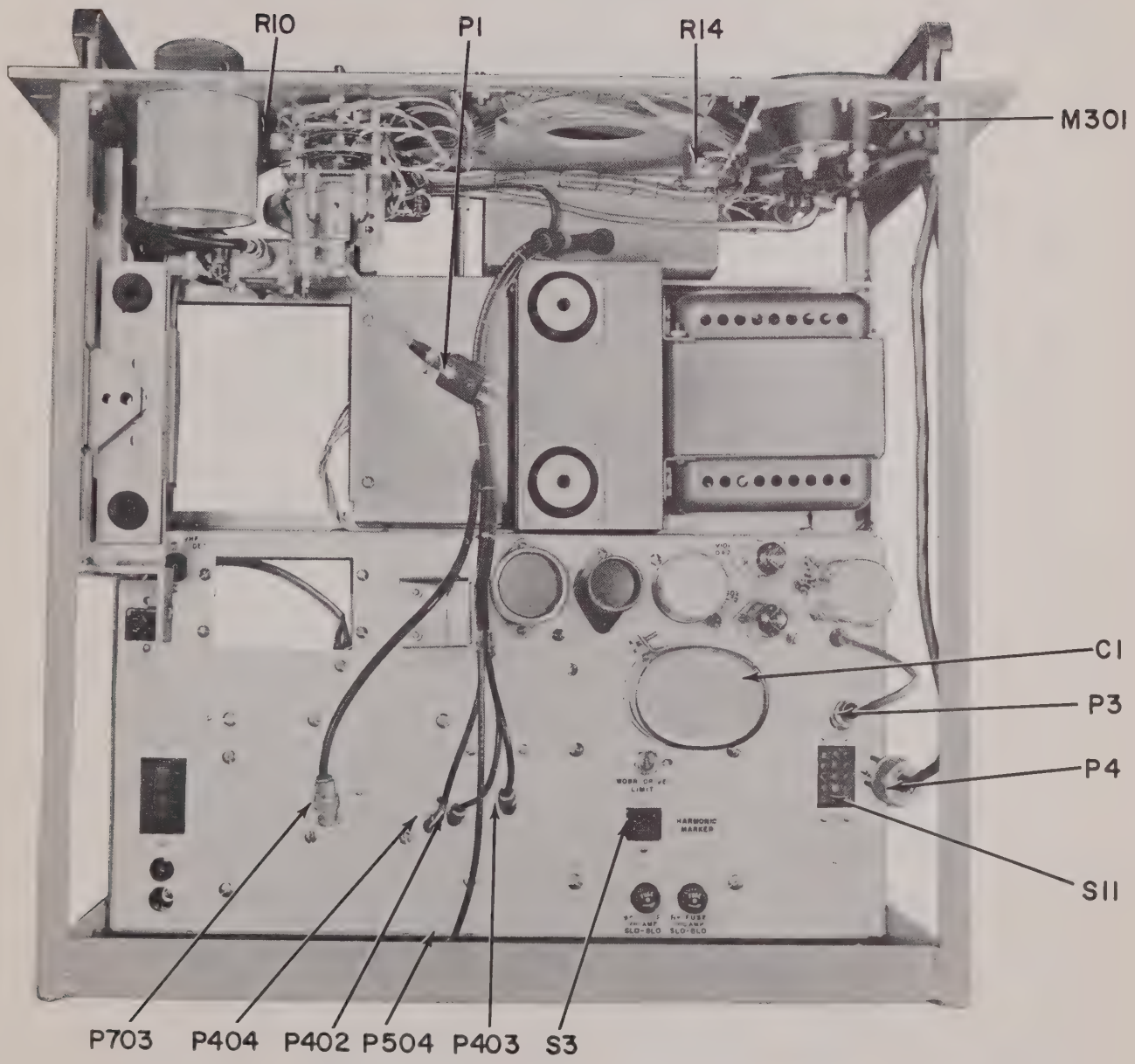



Fig. 65—Top View of Model 900-B with Modules Removed, Showing Component Location

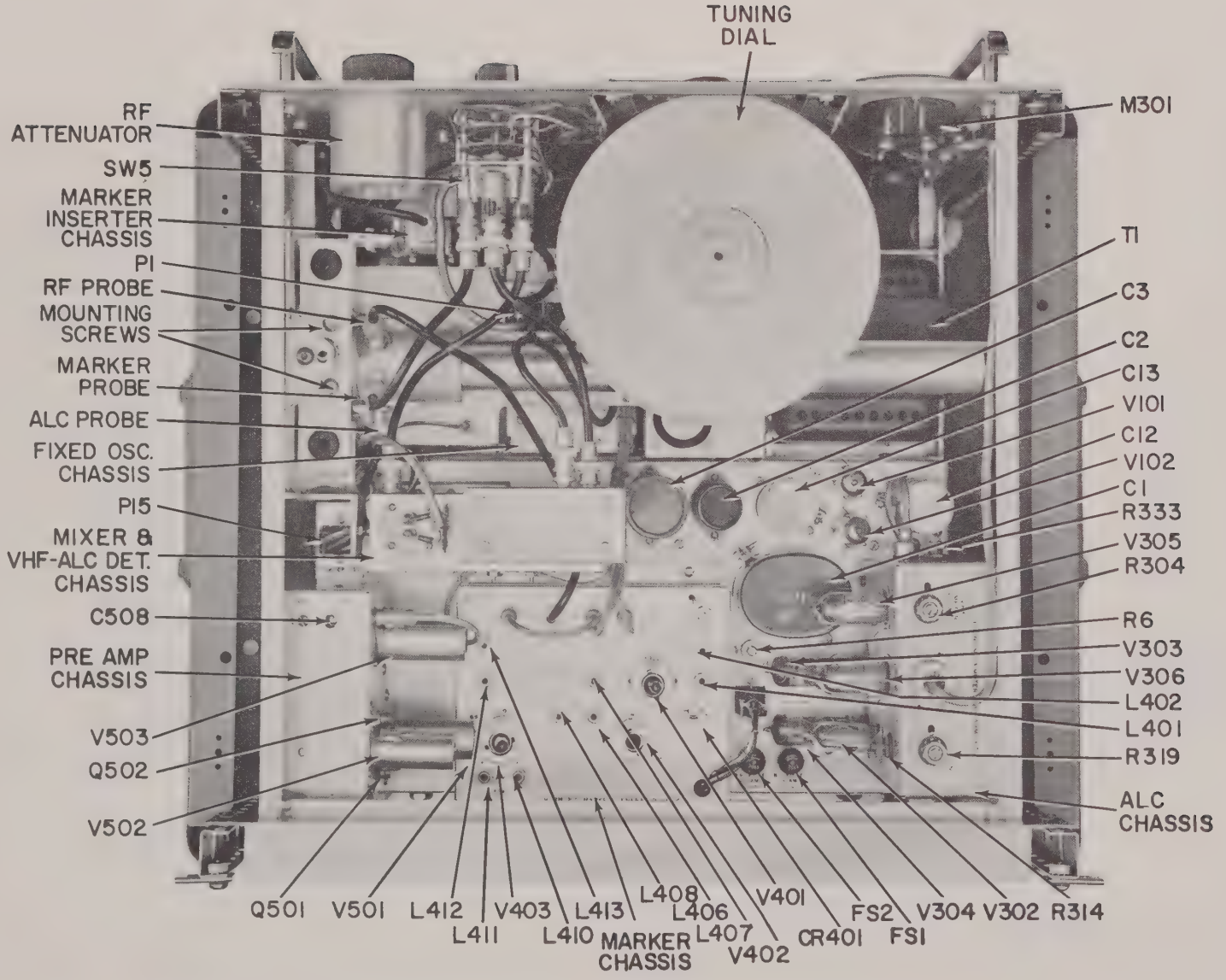



Fig. 66—Top View of Model 900-B, with Modules in Place, Showing Component Location

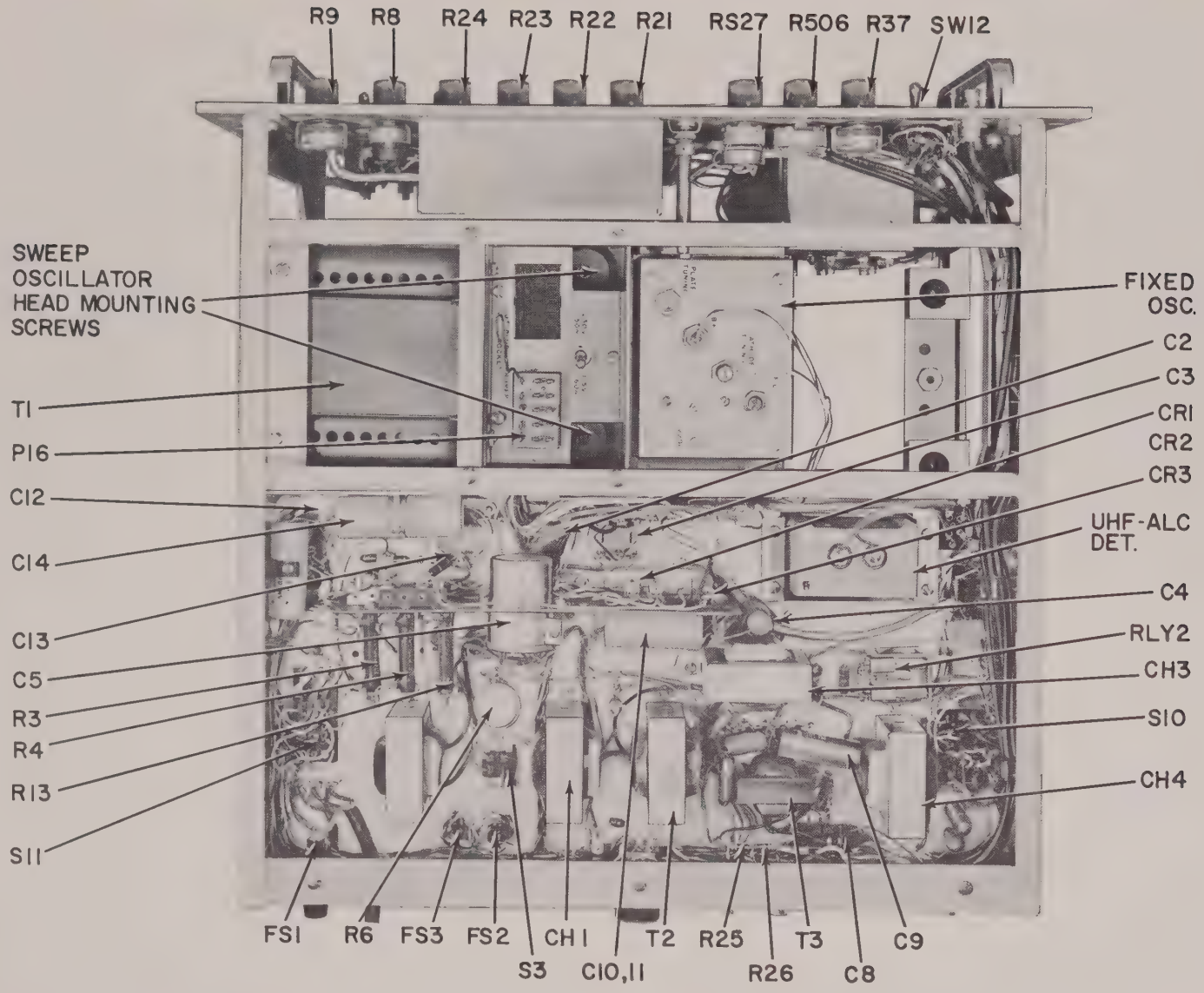



Fig. 67—Bottom View of Model 900-B, Showing Component Location

## TABLE 4. TROUBLE SHOOTING CHART

| Check: | Remedy: |
|---|---|
| **SYMPTOM: No UHF or VHF output.** | |
| a. Fuses FS2 and 3. | a. If blown, determine the reason, repair or replace faulty component and replace fuse. |
| b. Rectifiers CR-, 2, 3, 4, and 5. | b. Replace bad rectifier observing polarity indicated in Dwg. No. 861-388. |
| c. Power supply voltages. | c. If proper voltages per Dwg. No. 861-388 are not present, determine reason and repair or replace faulty component. |
| d. 6-prong Jones receptacle S4 for proper voltages to sweep oscillator. | d. Isolate trouble and repair or replace faulty component. |
| e. V601. | e. Replace defective tube (paragraph 6-7). |
| f. UHF probe assembly by removing connector RED cable from coaxial switch and measuring resistance of probe assembly from connector end with ohmmeter. Measured resistance should be 50 ohms. | f. Replace defective probe. |
| g. Coaxial switch by bypassing switch with a coupling barrel. | g. Replace defective switch. |
| h. D-50B detector crystals CR901 and 902 for proper polarity per Dwg. No. 861-387, and for forward and reverse resistance. Forward resistance should be 100 to 200 ohms and reverse resistance should be 50 k ohms to 200 k ohms. | h. Replace faulty crystals (paragraph 6-3). |
| i. Tubes V301, 302, 303, and 304. | i. Replace defective tube. |
| j. Filter barrels FB601, 602, and 603 for shorts or opens. | j. Replace defective filter barrel. |
| **SYMPTOM: UHF output but no VHF output.** | |
| a. V201. | a. If tube is defective, replace it (paragraph 6-6). |
| b. Cable connections to and from mixer. | b. Replace faulty connectors. |
| c. Coaxial switch by bypassing switch with a coupler barrel. | c. Replace defective switch. |
| d. B+ current on V201 by inserting a milliammeter between the plate and L206. Should read less than 20 ma. | d. If reading is 20 ma or more, replace V201 (paragraph 6-6). |
| e. Mixer crystals CR701 and 702 for proper polarity per DWG. No. 861-389, and check forward and reverse resistance with ohmmeter. Should measure 100 and 200 ohms forward and 50 k to 200 k ohms reverse. | e. Replace faulty crystals (paragraph 6-4). |
| **SYMPTOM: No ALC action on either UHF or VHF output.** | |
| a. Tubes V301, 302, 303 and 304. | a. Replace defective tube. |
| b. Contacts of RLY3. | b. Clean contacts. |
| **SYMPTOM: No ALC action on UHF.** | |
| a. Contacts on RLY3. | a. Clean contacts. |
| b. Crystal diodes CR101 and 102 for proper polarity per Dwg. No. 861-389, and check forward and reverse resistance. Should measure 100 to 200 ohms forward and 50 k to 200 k ohms reverse. | b. Replace faulty crystals (paragraph 6-3). |

**TABLE 4. TROUBLE SHOOTING CHART**—(Continued)

| Check: | Remedy: |
|---|---|
| **SYMPTOM: No ALC action on VHF.** | |
| a. Contacts on RLY3. | a. Clean contacts. |
| b. Coil of relay RLY3 for condition and for the necessary 5 v dc operating voltage.<br><br>Note: If relay RLY3 does not operate, V201 will not receive B+ and there will be no VHF. | b. Repair or replace defective component. |
| **SYMPTOM: ALC functions but does not flatten response to specifications on VHF range.** | |
| a. To isolate trouble. | a. (1) Find and correct error in test set-up. |
| (1) Connect a 50-ohm patch cord between the RF output and the D-50B detector. If response flattens, the trouble is in the external test set-up. If not, proceed to the next step. | |
| (2) Open the 900B cabinet and connect the mixer output terminal, J702, directly to the D-50B detector. If the response does not flatten, and the detector response is known to be flat, the mixer is misaligned. If the response does flatten, the trouble may be in the BAND SELECTOR switch, the marker inserter, or the r-f attenuator. By pass each in turn to determine if any of these components is faulty. If the response does not flatten, proceed to the next step. | (2) Align mixer (paragraph 6-10), or repair or replace faulty component. |
| (3) Crystals CR703 and 704 for proper polarity per Dwg. No. 861-389, and measure forward and reverse resistance. Forward resistance should be 100 to 200 ohms and reverse resistance should be 50 k to 200 k ohms. | (3) Replace faulty crystals (paragraph 6-5). |
| **SYMPTOM: Response is generally flat, but rises sharply at zero beat on VHF range.** | |
| a. Crystals CR703 and 704 for proper polarity per Dwg. No. 861-389 and measure forward and reverse resistance with ohmmeter. Forward resistance should be 100 to 200 ohms and reverse resistance should be 50 k to 200 k ohms. | a. Replace faulty crystals (paragraph 6-5). |
| **SYMPTOM: Insufficient sweep width.** | |
| a. Warm-up time. | a. Allow unit to warm up at least 30 minutes. |
| b. Setting of SWEEP WIDTH control. | b. Reset for proper sweep width. |
| c. Wobbulator motor. | c. If defective, return unit to factory. |
| d. Misadjustment of WOBB DRIVE LIMIT control. | d. Readjust for proper sweep width. |

TABLE 4. TROUBLE SHOOTING CHART—(Continued)

**SYMPTOM: Insufficient r-f output voltage on both UHF and VHF.**

| Check: | Remedy: |
|---|---|
| a. 6-prong Jones receptacle S4 for proper voltages to sweep oscillator. | a. Isolate trouble and repair or replace faulty component. |
| b. V601. | b. Replace if defective (paragraph 6-7). |
| c. Coupling of pick-up probe on RED cable. | c. This probe has been carefully adjusted at the factory and the setting should not be disturbed unless it is impossible to ship the instrument to the factory. The emergency procedure follows:<br>(1) Set 900-B for UHF-Wide operation at maximum sweep width and at highest frequency. Turn RF OUTPUT control fully clockwise.<br>(2) Disconnect the RED probe cable from the coaxial switch.<br>(3) Loosen the locknut and screw probe in one turn at a time checking the response each time by connecting it back to the coaxial switch. As the probe is screwed in, the display should increase in amplitude until the high-frequency end of the response starts to drop. Now back the probe out till the response no longer drops. Tighten locknut.<br>(4) Set SWEEP WIDTH control to NARROW and turn on 100 mc marker. Tune frequency dial to 600 mc and see if marker agrees with the dial at this point. If not, loosen lock nut and move probe slightly either in or out until the marker agrees with the dial setting. Then tighten locknut.<br>(5) Recalibrate the meter circuit as per paragraph 6-13.<br>(6) If detector D-50B is being used, check CR901 and 902 as per SYMPTOM: No UHF or VHF output voltage (h) in this chart. |

**SYMPTOM: SWEEP WIDTH control acts rubbery at maximum sweep width position.**

| Check: | Remedy: |
|---|---|
| a. To see if the condition (due to a change in compliance of the wobbulator motor suspension) is really disturbing to the operator. | a. If intolerable, return unit to factory for wobbulator drive replacement. |

**SYMPTOM: Response breaks up erratically and changes with setting of SWEEP WIDTH control.**

| Check: | Remedy: |
|---|---|
| a. Wobbulator motor voice coil for open circuit. | a. Replace wobbulator motor. |
| b. Wobbulator drive circuit and voltage per Dwg. No. 861-389. | b. Locate trouble and repair or replace defective component. |
| c. Transformer T1 for open winding. | c. Replace transformer, if defective. |

**TABLE 4. TROUBLE SHOOTING CHART**—(Continued)

| Check: | Remedy: |
|---|---|
| **SYMPTOM: Changing center frequency with main tuning knob, causes response to be erratic and jumpy at certain frequencies, especially the higher UHF.** | |
| a. For intermittent contact on inner slider due to dirt or wear. | a. Return unit to factory for cleaning and lubrication. |
| **SYMPTOM: No blanking.** | |
| a. V306. | a. Replace defective tube. |
| b. Blanking switch SW10. | b. Replace defective switch. |
| c. Voltages in blanking circuit per Dwg. No. 861-383. | c. Locate trouble and repair or replace defective component. |
| **SYMPTOM: Cannot balance preamplifier with BAL control.** | |
| a. V501 for balance. | a. If off, select another tube. |
| b. Transistors Q501 and Q502 for balance. | b. If off, select other transistors. |
| **SYMPTOM: Trace jitters when tapping instrument, even at wide sweep widths.** | |
| a. V501 for microphonics. | a. Replace tube. |
| **SYMPTOM: Birdy markers do not change to narrow when in narrow sweep position.** | |
| a. Relay RLY1 contacts. | a. Clean contacts. |
| b. Relay RLY 1 for 5 v dc operating voltage. | b. Locate trouble and repair or replace defective component. |
| c. Relay RLY1 coil for continuity. | c. Repair or replace relay. |
| **SYMPTOM: No markers appear on pattern.** | |
| a. Oscilloscope vertical sensitivity. Should be 0.1 v per cm. | a. Change setting if incorrect. |
| b. To see that detected signal goes through preamplifier. | b. Locate trouble and repair or replace defective component. |
| c. Voltages to marker generators. | c. Locate trouble and repair or replace defective component. |
| d. R-f probe connection to marker generator. | d. Make connection. |
| e. Test points on markers for proper voltage with VTVM. Should be 15 volts at 10 mc test point and 1 volt at 100 mc test point. | e. Locate trouble and repair or replace defective component. |
| f. 5 mc crystal CR401. | f. Replace defective crystal. |
| g. V401. | g. Replace defective tube. |

# REPLACEMENT PARTS LIST

## SWEEP SIGNAL GENERATOR MODEL 900B

The quantity entries in the list refer to the total quantity for the entire Model 900-B. Generally, the following chart will aid in determining the physical location of each component and the schematic diagram in which it appears.

| SCHEMATIC DESIGNATIONS | PHYSICAL LOCATION | DRAWING NO. |
|---|---|---|
| 1- 99 | Front Panel or Main Chassis | All |
| 101-199 | ALC UHF Detector Chassis | 861-389 |
| 201-299 | Fixed Oscillator Chassis | 861-389 |
| 301-399 | ALC Chassis | 861-383 |
| 401-499 | Harmonic Marker Chassis | 861-386 |
| 501-599 | Preamp Chassis | 861-387 |
| 601-699 | Sweep Oscillator Chassis | 861-389 |
| 701-799 | Mixer Chassis | 861-389 |
| 801-899 | Main Chassis | 861-386 |
| 901-999 | D-50B Detector Chassis | 861-387 |

| ITEM | SCHEMATIC DESIGNATION | QTY. | DESCRIPTION | JERROLD PART NO. |
|---|---|---|---|---|
| | | | **ATTENUATOR** | |
| 1 | RF ATTENUATOR | 1 | RF Attenuator | 107-005 |
| | | | **CAPACITORS** | |
| 2 | C1 | 1 | P o Transformer T1 | —— |
| 3 | C2 | 1 | 40 uf, 450 v, electrolytic | 127-505 |
| 4 | C3 | 1 | 40 uf, 50 v, electrolytic | 127-023 |
| 5 | C4 | 1 | 4 uf, 450 v, electrolytic | 127-030 |
| 6 | C5A/B | 1 | 50/30 uf, 350 v, electrolytic | 127-602 |
| 7 | C8 | 1 | 0.1 uf, 200 v, molded | 125-020 |
| 8 | C9 | 1 | 0.22 uf, 400 v, molded | 125-024 |
| 9 | C10, 11, 14 | 3 | 1500 uf, 6 v, electrolytic | 127-008 |
| 10 | C12, 13 | 2 | 3000 uf, 15 v, electrolytic | 127-500 |
| 11 | C15 | 1 | 1500 uf, 50 v, electrolytic | 127-501 |
| 12 | C20-24 | 4 | 300 pf, cer. | 123-123 |
| 13 | C25 | 1 | 2000 pf, 400 v, molded | 125-029 |
| 14 | C26, 27 | 2 | Factory selected | —— |
| 15 | C101 | 3 | 1000 pf. mica button | 129-153 |
| 16 | C102 | 3 | 47 pf, feed-thru | 129-202 |
| 17 | C103 | 3 | 1000 pf, feed-thru | 129-200 |
| 18 | C201, 206 | 4 | 0.9-3.5 pf, trimmer (HFT-65A) | 821-203 |
| 19 | C202 | 1 | 1000 pf. mica button | 129-155 |
| 20 | C203 | 1 | 40 pf, capacitor ass'y | 811-122 |
| 21 | C204 | 1 | 1.5 pf | 121-049 |
| 22 | C205 | 1 | 1.3-5.4 pf, trimmer | 128-509 |
| 23 | C301, 302 | 2 | 0.01 uf, 400 v | 125-013 |
| 24 | C303, 304 | 3 | 0.047 uf, 400 v, molded | 125-001 |
| 25 | C305 | 1 | 1.0 uf, 200 v | 125-019 |
| 26 | C306, 307 | 2 | 7.5 pf, ± 0.5 pf, 600 v | 125-053 |
| 27 | C308 | 1 | 0.02 uf, 400 v, molded | 125-015 |
| 28 | C401, 406, 407, 435, 436, 437 | 6 | 0.02 uf, cer. disc | 124-034 |
| 29 | C402, 403 | 2 | 120 pf, silver mica | 126-011 |
| 30 | C404 | 1 | 3.3 pf, temp. coef. | 121-006 |
| 31 | C405 | 1 | 20 pf, temp. coef. | 121-014 |
| 32 | C408, 409, 416, 433 | 4 | 47 pf, cer. | 123-125 |
| 33 | C410, 415, 434 | 6 | 0.73 pf, trimmer | 128-515 |
| 34 | C417 | 1 | 0.75 pf, temp. coef. | 121-048 |
| 35 | C418 | 1 | 39 pf, cer. | 123-211 |
| 36 | C419 | 1 | 160 pf, silver mica | 126-010 |
| 37 | C420, 424 | 2 | 150 pf, silver mica | 126-008 |
| 38 | C421, 422, 426, 430 | 4 | 0.01 uf, cer. disc | 124-031 |
| 39 | C423 | 1 | 30 pf, silver mica | 126-050 |
| 40 | C425, 431 | 2 | 1.5 pf, temp. coef. | 121-003 |
| 41 | C427, 428 | 2 | 24 pf, temp. coef. | 121-016 |
| 42 | C429, 432 | 2 | 1.0 pf, temp. coef. | 121-003 |
| 43 | C501, 502, 503 | 3 | 12 uf, 150 v, electrolytic | 127-016 |
| 44 | C504 | 1 | 170-780 pf, trimmer | 128-521 |
| 45 | C507, 509, 512 | 3 | 0.25 uf, 200 v | 125-008 |
| 46 | C508 | 1 | 25-280 pf, trimmer | 128-517 |
| 47 | C510 | 1 | 1500 pf, mica | 126-033 |
| 48 | C511 | 1 | 2000 pf, cer. | 123-117 |
| 49 | C513 | 1 | 1800 pf, mica | 126-030 |
| 50 | C514 | 1 | 0.02 uf, 200 v | 125-042 |
| 51 | C515 | 1 | 80-480 pf, trimmer | 128-513 |
| 52 | C516, 517 | 2 | 0.1 uf, 200 v | 125-002 |
| 53 | C524 | 3 | 0.047 uf, 400 v, paper | 125-001 |
| 54 | C601 | 1 | Wobbulator capacitor | 128-210 |
| 55 | GRID CAP. | 1 | P/o grid flange | 128-204 |
| 56 | PLATE CAP. | 1 | P/o coaxial inductor | 128-203 |
| 57 | C701, 703, 715 | 6 | 0.7-3 pf, trimmer | 128-515 |
| 58 | C702, 707 | 4 | 0.9-3.5 pf, trimmer (HFT-65A) | 821-203 |
| 59 | C708 | 3 | 1000 pf, feed-thru | 129-200 |
| 60 | C709 | 3 | 1000 pf, mica button | 129-153 |
| 61 | C710 | 3 | 47 pf, feed-thru | 129-202 |
| 62 | C711, 712 | 2 | 0.25 uf, 200 v, paper | 125-008 |
| 63 | C713, 714 | 2 | 5400 pf, feed-thru | 129-150 |
| 64 | C716 | 1 | 0.35-1.37, trimmer | 128-541 |
| 65 | C801 | 1 | 25 pf, cer. | 123-101 |
| 66 | C802 | 1 | 1.8 pf, feed-thru | 129-203 |
| 67 | C901 | 3 | 1000 pf, feed-thru | 129-200 |
| 68 | C902 | 3 | 47 pf, feed-thru | 129-202 |
| 69 | C903 | 3 | 1000 pf, mica button | 129-153 |
| | | | **CONNECTORS** | |
| 70 | J1-10<br>J7-10 | 20 | Receptacle, BNC<br>Receptacle, BNC, p/o Coaxial Switch Ass'y 822-042) | 188-103 |
| 71 | J401 | 20 | Receptacle, BNC | 188-103 |
| 72 | J501 | 20 | Receptacle, BNC | 188-103 |
| 73 | J502 | 1 | Phone jack, closed-circuit | 185-100 |
| 74 | J701, 702, 703 | 20 | Receptacle, BNC | 188-103 |
| 75 | J801, 802, 803 | 20 | Receptacle, BNC | 188-103 |
| 76 | J901, 902 | 20 | Receptacle, BNC | 188-103 |
| 77 | P1 | 2 | Plug, multi-pin | 184-030 |
| 78 | P3, 4 | 2 | Plug, multi-pin | 184-013 |
| 79 | P5 | 1 | Plug, multi-pin | 182-123 |
| 80 | P15 | 1 | Plug, multi-pin | 184-010 |
| 81 | P16 | 1 | Plug, multi-pin | 184-028 |
| 82 | P17, 18 | 2 | Plug, banana | 184-020 |
| 83 | P20 | 1 | Plug, tip | 184-042 |
| 84 | P301 | 1 | Plug, multi-pin | 184-031 |
| 85 | P302 | 1 | Plug, multi-pin | 184-032 |
| 86 | P401 | 2 | Plug, multi-pin | 184-030 |
| 87 | P402, 403, 404 | 3 | Plug, phone (p/o Cable Ass'y 655-078-2) | 655-078-2 |
| 88 | P501 | 1 | Plug, multi-pin | 184-035 |
| 89 | P502, 503, 504 | 3 | Plug, phone (p/o Cable Ass'y 655-078-2) | 655-078-2 |
| 90 | S1, 2, 10 | 3 | Receptacle, multi-pin | 182-115 |
| 91 | S3, 12 | 2 | Receptacle, multi-pin | 184-018 |
| 92 | S4 | 1 | Receptacle, multi-pin | 182-114 |
| 93 | S5 | 1 | Receptacle, multi-pin | 184-008 |
| 94 | S6 | 2 | Receptacle, multi-pin | 182-103 |
| 95 | S11 | 1 | Receptacle, multi-pin | 182-116 |
| 96 | S301 | 1 | Receptacle, multi-pin | 182-117 |
| 97 | S302 | 2 | Receptacle, multi-pin | 182-103 |
| 98 | S402, 403, 404 | 6 | Jack, phone | 185-116 |
| 99 | S502, 503, 504 | 6 | Jack, phone | 185-116 |
| 100 | S901, 902 | 2 | Jack, banana | 185-107 |
| | | | **CRYSTAL** | |
| 101 | CR401 | 1 | Crystal, 5MC (32 pf, 26°C) | 139-118 |
| | | | **ELECTRON TUBES** | |
| 102 | V1, 2 | 2 | 0A2 | 132-100 |
| 103 | V201 | 1 | 5675 | 131-501 |

**TABLE 4. TROUBLE SHOOTING CHART**—(Continued)

| Check: | Remedy: |
|---|---|
| **SYMPTOM: Changing center frequency with main tuning knob, causes response to be erratic and jumpy at certain frequencies, especially the higher UHF.** | |
| a. For intermittent contact on inner slider due to dirt or wear. | a. Return unit to factory for cleaning and lubrication. |
| **SYMPTOM: No blanking.** | |
| a. V306. | a. Replace defective tube. |
| b. Blanking switch SW10. | b. Replace defective switch. |
| c. Voltages in blanking circuit per Dwg. No. 861-383. | c. Locate trouble and repair or replace defective component. |
| **SYMPTOM: Cannot balance preamplifier with BAL control.** | |
| a. V501 for balance. | a. If off, select another tube. |
| b. Transistors Q501 and Q502 for balance. | b. If off, select other transistors. |
| **SYMPTOM: Trace jitters when tapping instrument, even at wide sweep widths.** | |
| a. V501 for microphonics. | a. Replace tube. |
| **SYMPTOM: Birdy markers do not change to narrow when in narrow sweep position.** | |
| a. Relay RLY1 contacts. | a. Clean contacts. |
| b. Relay RLY 1 for 5 v dc operating voltage. | b. Locate trouble and repair or replace defective component. |
| c. Relay RLY1 coil for continuity. | c. Repair or replace relay. |
| **SYMPTOM: No markers appear on pattern.** | |
| a. Oscilloscope vertical sensitivity. Should be 0.1 v per cm. | a. Change setting if incorrect. |
| b. To see that detected signal goes through preamplifier. | b. Locate trouble and repair or replace defective component. |
| c. Voltages to marker generators. | c. Locate trouble and repair or replace defective component. |
| d. R-f probe connection to marker generator. | d. Make connection. |
| e. Test points on markers for proper voltage with VTVM. Should be 15 volts at 10 mc test point and 1 volt at 100 mc test point. | e. Locate trouble and repair or replace defective component. |
| f. 5 mc crystal CR401. | f. Replace defective crystal. |
| g. V401. | g. Replace defective tube. |

# REPLACEMENT PARTS LIST

## SWEEP SIGNAL GENERATOR MODEL 900B

The quantity entries in the list refer to the total quantity for the entire Model 900-B. Generally, the following chart will aid in determining the physical location of each component and the schematic diagram in which it appears.

| SCHEMATIC DESIGNATIONS | PHYSICAL LOCATION | DRAWING NO. |
|---|---|---|
| 1- 99 | Front Panel or Main Chassis | All |
| 101-199 | ALC UHF Detector Chassis | 861-389 |
| 201-299 | Fixed Oscillator Chassis | 861-389 |
| 301-399 | ALC Chassis | 861-383 |
| 401-499 | Harmonic Marker Chassis | 861-386 |
| 501-599 | Preamp Chassis | 861-387 |
| 601-699 | Sweep Oscillator Chassis | 861-389 |
| 701-799 | Mixer Chassis | 861-389 |
| 801-899 | Main Chassis | 861-386 |
| 901-999 | D-50B Detector Chassis | 861-387 |

| ITEM | SCHEMATIC DESIGNATION | QTY. | DESCRIPTION | JERROLD PART NO. |
|---|---|---|---|---|
| | | | **ATTENUATOR** | |
| 1 | RF ATTENUATOR | 1 | RF Attenuator | 107-005 |
| | | | **CAPACITORS** | |
| 2 | C1 | 1 | P/o Transformer T1 | —— |
| 3 | C2 | 1 | 40 uf, 450 v, electrolytic | 127-505 |
| 4 | C3 | 1 | 40 uf, 50 v, electrolytic | 127-023 |
| 5 | C4 | 1 | 4 uf, 450 v, electrolytic | 127-030 |
| 6 | C5A, B | 1 | 50 30 uf, 350 v, electrolytic | 127-602 |
| 7 | C8 | 1 | 0.1 uf, 200 v, molded | 125-020 |
| 8 | C9 | 1 | 0.22 uf, 400 v, molded | 125-024 |
| 9 | C10, 11, 14 | 3 | 1500 uf, 6 v, electrolytic | 127-008 |
| 10 | C12, 13 | 2 | 3000 uf, 15 v, electrolytic | 127-500 |
| 11 | C15 | 1 | 1500 uf, 50 v, electrolytic | 127-501 |
| 12 | C20-24 | 4 | 300 pf, cer. | 123-123 |
| 13 | C25 | 1 | 2000 pf, 400 v, molded | 125-029 |
| 14 | C26, 27 | 2 | Factory selected | —— |
| 15 | C101 | 3 | 1000 pf, mica button | 129-153 |
| 16 | C102 | 3 | 47 pf, feed-thru | 129-202 |
| 17 | C103 | 3 | 1000 pf, feed-thru | 129-200 |
| 18 | C201, 206 | 4 | 0.9-3.5 pf, trimmer (HFT-65A) | 821-203 |
| 19 | C202 | 1 | 1000 pf, mica button | 129-155 |
| 20 | C203 | 1 | 40 pf, capacitor ass'y | 811-122 |
| 21 | C204 | 1 | 1.5 pf | 121-049 |
| 22 | C205 | 1 | 1.3-5.4 pf, trimmer | 128-509 |
| 23 | C301, 302 | 2 | 0.01 uf, 400 v | 125-013 |
| 24 | C303, 304 | 3 | 0.047 uf, 400 v, molded | 125-001 |
| 25 | C305 | 1 | 1.0 uf, 200 v | 125-019 |
| 26 | C306, 307 | 2 | 7.5 pf, ± 0.5 pf, 600 v | 125-053 |
| 27 | C308 | 1 | 0.02 uf, 400 v, molded | 125-015 |
| 28 | C401, 406, 407, 435, 436, 437 | 6 | 0.02 uf, cer. disc | 124-034 |
| 29 | C402, 403 | 2 | 120 pf, silver mica | 126-011 |
| 30 | C404 | 1 | 3.3 pf, temp. coef. | 121-006 |
| 31 | C405 | 1 | 20 pf, temp. coef. | 121-014 |
| 32 | C408, 409, 416, 433 | 4 | 47 pf, cer. | 123-125 |
| 33 | C410, 415, 434 | 6 | 0.73 pf, trimmer | 128-515 |
| 34 | C417 | 1 | 0.75 pf, temp. coef. | 121-048 |
| 35 | C418 | 1 | 39 pf, cer. | 123-211 |
| 36 | C419 | 1 | 160 pf, silver mica | 126-010 |
| 37 | C420, 424 | 2 | 150 pf, silver mica | 126-008 |
| 38 | C421, 422, 426, 430 | 4 | 0.01 uf, cer. disc | 124-031 |
| 39 | C423 | 1 | 30 pf, silver mica | 126-050 |
| 40 | C425, 431 | 2 | 1.5 pf, temp. coef. | 121-003 |
| 41 | C427, 428 | 2 | 24 pf, temp. coef. | 121-016 |
| 42 | C429, 432 | 2 | 1.0 pf, temp. coef. | 121-003 |
| 43 | C501, 502, 503 | 3 | 12 uf, 150 v, electrolytic | 127-016 |
| 44 | C504 | 1 | 170-780 pf, trimmer | 128-521 |
| 45 | C507, 509, 512 | 3 | 0.25 uf, 200 v | 125-008 |
| 46 | C508 | 1 | 25-280 pf, trimmer | 128-517 |
| 47 | C510 | 1 | 1500 pf, mica | 126-033 |
| 48 | C511 | 1 | 2000 pf, cer. | 123-117 |
| 49 | C513 | 1 | 1800 pf, mica | 126-030 |
| 50 | C514 | 1 | 0.02 uf, 200 v | 125-042 |
| 51 | C515 | 1 | 80-480 pf, trimmer | 128-513 |
| 52 | C516, 517 | 2 | 0.1 uf, 200 v | 125-002 |
| 53 | C524 | 3 | 0.047 uf, 400 v, paper | 125-001 |
| 54 | C601 | 1 | Wobbulator capacitor | 128-210 |
| 55 | GRID CAP. | 1 | P/o grid flange | 128-204 |
| 56 | PLATE CAP. | 1 | P/o coaxial inductor | 128-203 |
| 57 | C701, 703, 715 | 6 | 0.7-3 pf, trimmer | 128-515 |
| 58 | C702, 707 | 4 | 0.9-3.5 pf, trimmer (HFT-65A) | 821-203 |
| 59 | C708 | 3 | 1000 pf, feed-thru | 129-200 |
| 60 | C709 | 3 | 1000 pf, mica button | 129-153 |
| 61 | C710 | 3 | 47 pf, feed-thru | 129-202 |
| 62 | C711, 712 | 2 | 0.25 uf, 200 v, paper | 125-008 |
| 63 | C713, 714 | 2 | 5400 pf, feed-thru | 129-150 |
| 64 | C716 | 1 | 0.35-1.37, trimmer | 128-541 |
| 65 | C801 | 1 | 25 pf, cer. | 123-101 |
| 66 | C802 | 1 | 1.8 pf, feed-thru | 129-203 |
| 67 | C901 | 3 | 1000 pf, feed-thru | 129-200 |
| 68 | C902 | 3 | 47 pf, feed-thru | 129-202 |
| 69 | C903 | 3 | 1000 pf, mica button | 129-153 |
| | | | **CONNECTORS** | |
| 70 | J1-10<br>J7-10 | 20 | Receptacle, BNC<br>Receptacle, BNC, p/o Coaxial Switch Ass'y 822-042) | 188-103 |
| 71 | J401 | 20 | Receptacle, BNC | 188-103 |
| 72 | J501 | 20 | Receptacle, BNC | 188-103 |
| 73 | J502 | 1 | Phone jack, closed-circuit | 185-100 |
| 74 | J701, 702, 703 | 20 | Receptacle, BNC | 188-103 |
| 75 | J801, 802, 803 | 20 | Receptacle, BNC | 188-103 |
| 76 | J901, 902 | 20 | Receptacle, BNC | 188-103 |
| 77 | P1 | 2 | Plug, multi-pin | 184-030 |
| 78 | P3, 4 | 2 | Plug, multi-pin | 184-013 |
| 79 | P5 | 1 | Plug, multi-pin | 182-123 |
| 80 | P15 | 1 | Plug, multi-pin | 184-010 |
| 81 | P16 | 1 | Plug, multi-pin | 184-028 |
| 82 | P17, 18 | 2 | Plug, banana | 184-020 |
| 83 | P20 | 1 | Plug, tip | 184-042 |
| 84 | P301 | 1 | Plug, multi-pin | 184-031 |
| 85 | P302 | 1 | Plug, multi-pin | 184-032 |
| 86 | P401 | 2 | Plug, multi-pin | 184-030 |
| 87 | P402, 403, 404 | 3 | Plug, phone (p/o Cable Ass'y 655-078-2) | 655-078-2 |
| 88 | P501 | 1 | Plug, multi-pin | 184-035 |
| 89 | P502, 503, 504 | 3 | Plug, phone (p/o Cable Ass'y 655-078-2) | 655-078-2 |
| 90 | S1, 2, 10 | 3 | Receptacle, multi-pin | 182-115 |
| 91 | S3, 12 | 2 | Receptacle, multi-pin | 184-018 |
| 92 | S4 | 1 | Receptacle, multi-pin | 182-114 |
| 93 | S5 | 1 | Receptacle, multi-pin | 184-008 |
| 94 | S6 | 2 | Receptacle, multi-pin | 182-103 |
| 95 | S11 | 1 | Receptacle, multi-pin | 182-116 |
| 96 | S301 | 1 | Receptacle, multi-pin | 182-117 |
| 97 | S302 | 2 | Receptacle, multi-pin | 182-103 |
| 98 | S402, 403, 404 | 6 | Jack, phone | 185-116 |
| 99 | S502, 503, 504 | 6 | Jack, phone | 185-116 |
| 100 | S901, 902 | 2 | Jack, banana | 185-107 |
| | | | **CRYSTAL** | |
| 101 | CR401 | 1 | Crystal, 5MC (32 pf, 26°C) | 139-118 |
| | | | **ELECTRON TUBES** | |
| 102 | V1, 2 | 2 | 0A2 | 132-100 |
| 103 | V201 | 1 | 5675 | 131-501 |

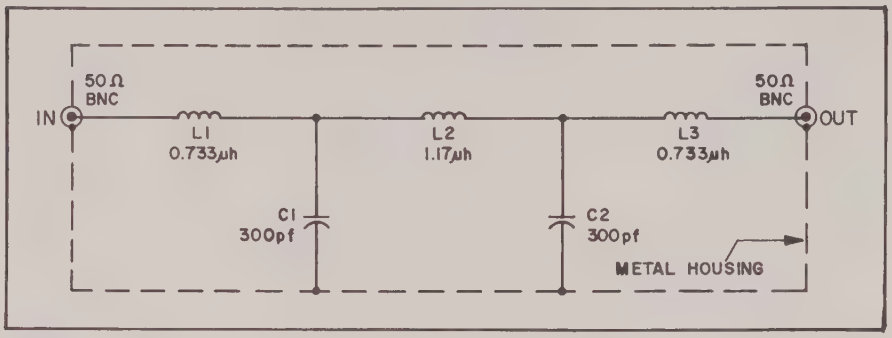
# REPLACEMENT PARTS LIST

| ITEM | SCHEMATIC DESIGNATION | QTY. | DESCRIPTION | JERROLD PART NO. |
|---|---|---|---|---|
| 104 | V301, 302 | 3 | 6AU6 | 131-308 |
| 105 | V303, 304 | 2 | 6CW5 | 131-337 |
| 106 | V305 | 3 | 6922 | 131-602 |
| 107 | V306 | 1 | 12AT7 | 131-400 |
| 108 | V401, 403 | 3 | 6922 | 131-602 |
| 109 | V402 | 1 | 6CB6 | 131-313 |
| 110 | V501 | 1 | 7308 | 131-603 |
| 111 | V502 | 3 | 6AU6 | 131-308 |
| 112 | V503 | 1 | 12AY7 | 131-402 |
| 113 | V601 | 1 | 5675 (modified) | 815-107 |
| | | | **FILTER BARREL ASSEMBLIES** | |
| 114 | FB201, 202 | 2 | Filter Barrel Ass'y | 221-164 |
| 115 | FB601, 602, 603 | 3 | Filter Barrel Ass'y | 823-018 |
| | | | **FUSES** | |
| 116 | FS1 | 1 | 3AG, 2 amp. | 101-240 |
| 117 | FS2, 3 | 2 | 3AG, 1/10 amp., slo-blo | 101-315 |
| | | | **INDICATOR LIGHTS** | |
| 118 | Scale Pointers | 8 | Lamp. neon, NE-2P | 102-005 |
| 119 | DS1, 2 | 2 | Lamp, No. 47, bayonet base | 102-002 |
| | | | **METER** | |
| 120 | M301 | | 100 ua | 171-207 |
| | | | **RECTIFIERS** | |
| 121 | CR1, 2, 3 | 3 | 750 ma, piv 800 v | 137-711 |
| 122 | CR4 | 1 | 1100 ma, 30 v | 137-709 |
| 123 | CR5, 6 | 2 | 3 amps, 20 v, piv 30 v | 137-729 |
| 124 | CR7 | 1 | 750 ma, piv 400 v | 137-712 |
| 125 | CR101, 102 | 4 | K-3A, red coded, w/o leads | 139-106 |
| 126 | CR401, 403, 405 | 3 | 1N87 | 139-119 |
| 127 | CR402, 404, 406 | 4 | K3A, with leads | 139-102 |
| 128 | CR701, 702 | 2 | K3A, blue coded, w/o leads | 139-107 |
| 129 | CR703, 704 | 2 | K3A, brown coded, w/o leads | 139-111 |
| 130 | CR801 | 4 | K3A, with leads | 139-102 |
| 131 | CR901, 902 | 4 | K3A, red coded, w/o leads | 139-106 |
| | | | **RELAYS** | |
| 132 | RLY1, 2, 3 | 3 | Dpdt, 6 vdc | 163-003 |
| | | | **RESISTORS** | |
| 133 | R1, 2 | 2 | 22 ohm, 10%, ½ w | 112-152 |
| 134 | R3 | 1 | 3.3 ohm, 5%, ½ w | 112-009 |
| 135 | R4 | 1 | 4 k, 10 w, w.w. | 113-060 |
| 136 | R5 | 1 | 5 k, 10 w, w.w. | 113-021 |
| 137 | R6 | 1 | 50 k, 2 w, potentiometer | 118-024 |
| 138 | R6A | 1 | 75 k, 5%, ½ w | 112-599 |
| 139 | R7 | 1 | 390 k, 5%, ½ w | 112-687 |
| 140 | R8/SW10, R21/SW6, R22/SW7, R23/SW8, R24/SW9 | 5 | 100 k, potentiometer w/spst push-pull switch | 118-047 |
| 141 | R9 | 1 | 100 k, 2 w, potentiometer | 118-063 |
| 142 | R10 | 1 | 5 k, ½ w, potentiometer | 118-082 |
| 143 | R11 | 1 | 220 k, 10%, ½ w | 112-656 |
| 144 | R13 | 1 | 17.5 k, 10 w, w.w. | 113-027 |
| 145 | R14 | 1 | 100 ohm, 2 w, potentiometer | 118-084 |
| 146 | R15 | 1 | 300 ohm, 10 w, w.w. | 113-001 |
| 147 | R16, 17 | 2 | 100 k, 10%, ½ w | 112-614 |
| 148 | R20 | 1 | Terminating Resistor Assembly, TR-53 | 821-142 |
| 149 | R25, 26, 27 | 3 | 33 ohm, 10%, ½ w | 112-173 |
| 150 | R28/SW11 | 1 | 50 k, ½ w, potentiometer w/spst push-pull switch | 118-085 |
| 151 | R29 | 1 | 500 k, ½ w, potentiometer | 118-088 |
| 152 | R32, 33 | 2 | 5.6M, 10%, ½ w | 112-836 |
| 153 | R34 | 1 | 680 k, 5%, ½ w | 112-716 |
| 154 | R35 | 1 | 750 k, 5%, ½ w | 112-725 |
| 155 | R36 | 1 | 3M, 5%, ½ w | 112-797 |
| 156 | R37 | 1 | 500 k, 2 w, potentiometer | 118-028 |
| 157 | R39, 42 | 2 | 5.1 k, 5%, ½ w | 112-452 |
| 158 | R40 | 3 | 130 k, 5%, ½ w | 112-629 |
| 159 | R41 | 1 | 10 ohm, 10%, 1 w | 112-108 |
| 160 | R43 | 1 | 1 ohm, 10%, 2 w | 113-063 |
| 161 | R44 | 1 | Factory selected | —— |
| 162 | R101, 103 | 6 | 300 ohm, 5%, ½ w | 112-293 |
| 163 | R102 | 10 | 100 k, 10%, ½ w | 112-614 |
| 164 | R201 | 1 | 100 ohm, 10%, ½ w | 112-236 |
| 165 | R202 | 1 | 4.7 k, 10%, ½ w | 112-446 |
| 166 | R301, 302 | 2 | 470 ohm, 10%, ½ w | 112-320 |
| 167 | R303, 320, 328 | 3 | 150 k, 10%, ½ w | 112-635 |
| 168 | R304 | 1 | 50 k, ½ w, potentiometer | 118-087 |
| 169 | R306, 317, 318 | 3 | 180 k, 5%, ½ w | 112-644 |
| 170 | R307 | 1 | 390 k, 10%, ½ w | 112-689 |
| 171 | R308, 313 | 10 | 100 k, 10%, ½ w | 112-614 |
| 172 | R310, 312, 323, 324 | 4 | 3.3M, 10%, ½ w | 112-803 |
| 173 | R311 | 1 | 470 k, 10%, ½ w | 112-698 |
| 174 | R314 | 1 | 100 k, ½ w, potentiometer | 118-083 |
| 175 | R315, 316 | 6 | 1 k, 10%, ½ w | 112-362 |
| 176 | R319 | 1 | 5 k, ½ w, potentiometer | 118-090 |
| 177 | R321, 322 | 2 | 560 k, 5%, ½ w | 112-707 |
| 178 | R325, 326 | 2 | 1.5M, 5%, ½ w | 112-758 |
| 179 | R327 | 1 | 3K, 10 w, w.w. | 113-016 |
| 180 | R330 | 1 | 10 k, 10%, 1 w | 112-489 |
| 181 | R331, 332 | 2 | 2.2 k, 10%, 2 w | 112-406 |
| 182 | R333 | 1 | 100 k, ½ w, potentiometer | 118-008 |
| 183 | R401 | 1 | 56 k, 5%, ½ w | 112-581 |
| 184 | R402, 415, 418, 419, 420 | 10 | 100 k, 10%, ½ w | 112-614 |
| 185 | R403, 407 | 2 | 10 k, 10%, ½ w | 112-485 |
| 186 | R404, 405 | 2 | 51 ohm, 5%, ½ w | 112-200 |
| 187 | R406, 411, 424 | 3 | 150 ohm, 5%, ½ w | 112-254 |
| 188 | R412, 423, 426 | 6 | 1 k, 10%, ½ w | 112-362 |
| 189 | R413, 421 | 2 | 51 k, 5%, ½ w | 112-578 |
| 190 | R414, 22 | 2 | 1M, 10%, ½ w • | 112-740 |
| 191 | R416 | 1 | 2.2M, 10%, ½ w | 112-782 |
| 192 | R417 | 1 | 47 k, 10%, ½ w | 112-572 |
| 193 | R425 | 1 | 10 k, potentiometer | 118-026 |
| 194 | R501, 502 | 3 | 130 k, 5%, ½ w | 112-629 |
| 195 | R503, 504 | 2 | 390 ohm, 5%, ½ w | 112-308 |
| 196 | R505, 511 | 2 | 1 k, ½ w, flexible | 110-028 |
| 197 | R506 | 1 | 25 k, 1 w, potentiometer | 118-080 |
| 198 | R507 | 1 | 1M, 5%, ½ w | 112-737 |
| 199 | R508 | 1 | 510 k, 5%, ½ w | 112-704 |
| 200 | R509, 510 | 1 | 68 k, 1% 1 w | 115-144 |
| 201 | R512, 514, 530 | 3 | 1.5 k, 10%, 2 w | 112-385 |
| 202 | R513, 528 | 2 | 82 k, 1%, 1 w | 115-049 |
| 203 | R517 | 1 | 75 k, 5%, 1 w | 112-600 |
| 204 | R526 | 1 | 106.73 ohm, 1%, ½ w | 115-020 |
| 205 | R527 | 1 | 1k/10k, dual potentiometer | 118-113 |
| 206 | R529, 538 | 2 | 30 k, 1%, ½ w | 115-143 |
| 207 | R531, 534, 536, 544 | 4 | 1 k, 5%, ½ w | 112-359 |
| 208 | R532 | 1 | 100 k, 5%, ½ w | 112-611 |
| 209 | R533 | 1 | 47 k, 5%, ½ w | 112-569 |
| 210 | R535, 537 | 2 | 316 k, 1%, ½ w | 115-145 |
| 211 | R541 | 1 | 68 k, 5%, ½ w | 112-590 |
| 212 | R542 | 1 | 510 k, 1%, ½ w | 115-104 |
| 213 | R543 | 1 | 1.87M, 1% | 115-153 |
| 214 | R601 | 1 | 4.7 k, 5%, ½ w | 112-443 |
| 215 | R602, R603 | 8 | 100 ohm, 5%, ¼ w, (p/o Cable Probe Ass'y 659-121) | 112-950 |
| 216 | R604, 605 | 8 | 100 ohm, 5%, ¼, w (p/o Cable Probe Ass'y 659-109) | 112-950 |
| 217 | R606, 607 | 8 | 100 ohm, 5%, ¼ w, (p/o Cable Probe Ass'y 659-122) | 112-950 |
| 218 | R701, 704 | 2 | 5.1 ohm, 5%, ½ w | 112-030 |
| 219 | R702 | 1 | 200 ohm, 5%, ½ w | 112-272 |
| 220 | R705, 706 | 8 | 100 ohm, 5%, ¼ w | 112-950 |
| 221 | R707, 709 | 6 | 300 ohm, 5%, ½ w | 112-293 |
| 222 | R708 | 10 | 100 k, 10%, ½ w | 112-614 |
| 223 | R801 | 1 | 5.6 k, 10%, ½ w | 112-458 |
| 224 | R802 | 6 | 1 k, 10%, ½ w | 112-362 |
| 225 | R901, 903 | 6 | 300 ohm, 5%, ½ w | 112-293 |
| 226 | R902 | 10 | 100 k, 10%, ½ w | 112-614 |
| | | | **SWITCHES** | |
| 227 | SW1 | 1 | Spst, toggle | 162-018 |
| 228 | SW2 | 1 | Switch, wafer, phenolic section only (p/o Coaxial Switch Ass'y 822-042) | 161-126 |
| 229 | SW3 | 1 | Switch, wafer (p/o Detent Switch Ass'y 811-239) | 161-124 |
| 230 | SW4, 12, 13 | 4 | Dpdt, toggle | 162-008 |
| 231 | SW5 | 1 | Switch, wafer (p/o Coaxial Switch Ass'y 822-042) | 161-127 |
| 232 | SW501 | 4 | Dpdt, toggle | 162-008 |
| | | | **TRANSFORMERS** | |
| 233 | T1 | 1 | Power Transformer | 141-175 |
| 234 | T2 | 1 | Transformer | 141-192 |
| 235 | T3 | 1 | Transformer | 141-176 |
| 236 | L501/502 | 1 | Transformer Assembly | 823-021 |
| | | | **TRANSISTORS** | |
| 237 | Q501, 502 | 2 | 2N1748A | 130-105 |

# Appendix

## A. CONSTRUCTION OF 16 MC CUTOFF FILTER

This test filter is for use in the alignment of the mixer stage of Model 900-B for minimum spurious beats.



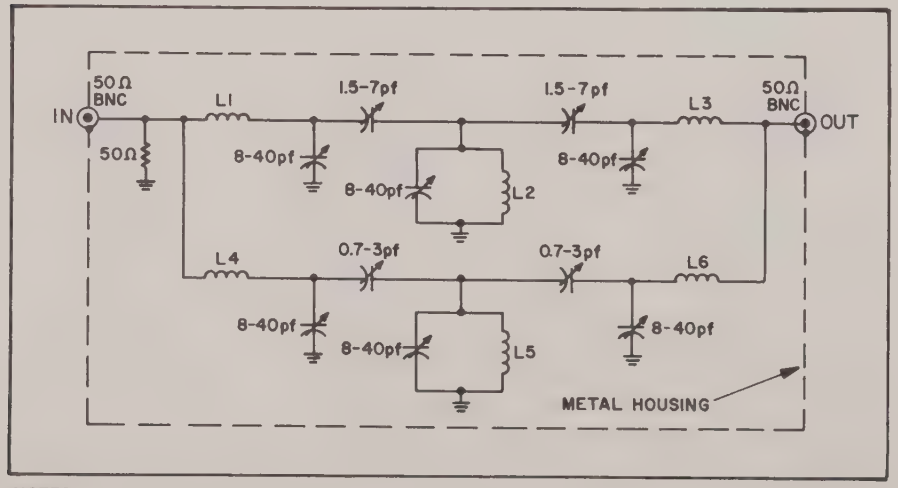

**NOTES:**

1. Make all lead lengths as short as practicable.
2. C1 and C2 are mica capacitors.
3. All coils use #22 SP wire wound on ⅜" dia. bakelite pigtail forms. The number of turns are indicated in the following table. After they are wound, the coils must be tweaked to obtain the indicated inductance values; the turns should then be cemented in place.

| Coil | No. of Turns | Inductance Value |
|---|---|---|
| L1 | 10 | 0.733 uh |
| L2 | 14 | 1.17 uh |
| L3 | 10 | 0.733 uh |

## B. CONSTRUCTION OF 15 MC BANDPASS FILTER

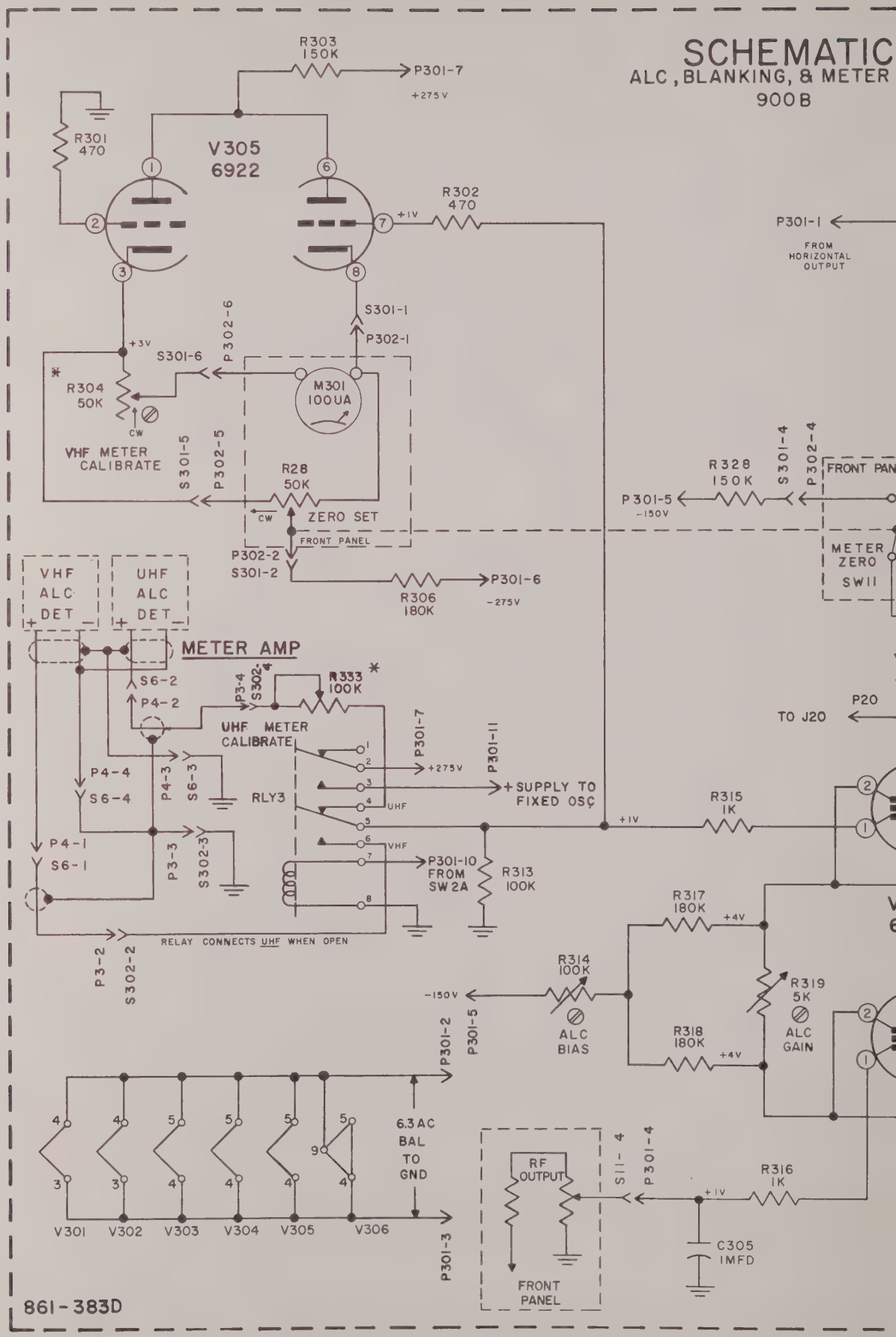
This test filter is for use in the alignment of the mixer stage of Model 900-B for minimum harmonic distortion.

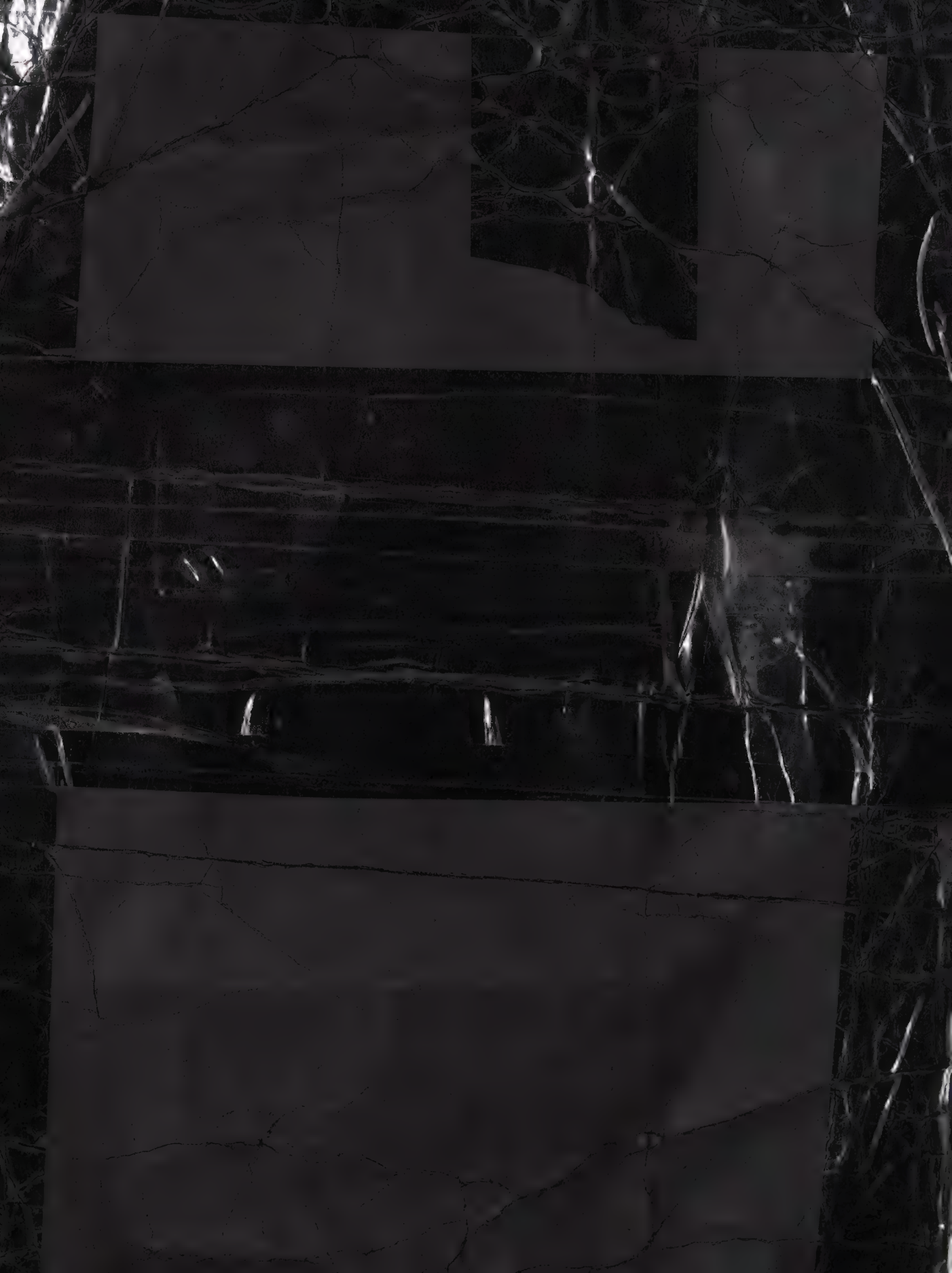


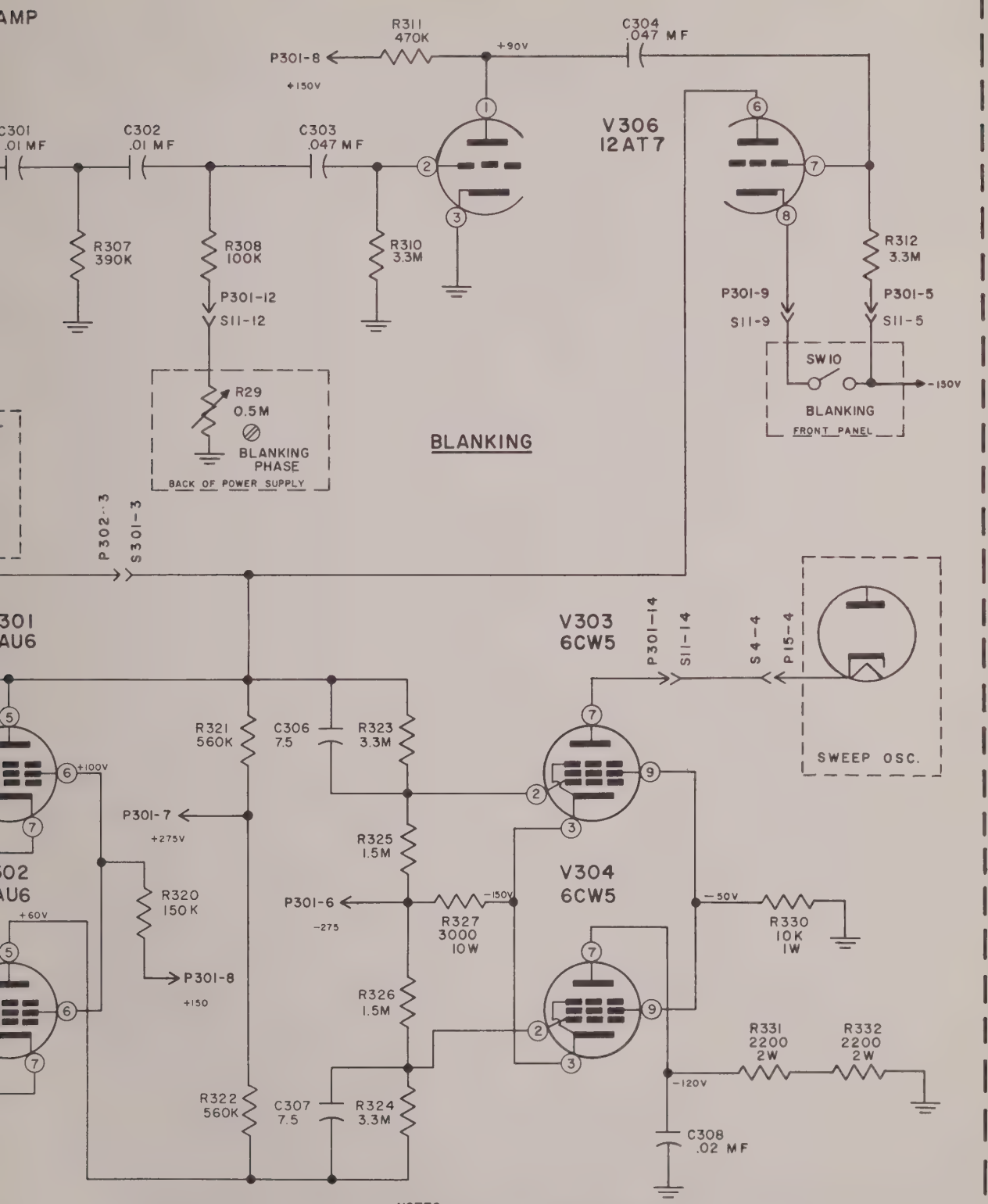

**NOTES:**

1. All coils use about 95 turns of #34 SP wire on ¼" dia. threaded paper forms.
2. L1, L2, L3 use threaded iron cores.
3. L4, L5, L6 use thread brass cores.
4. L1,L2, L3 affect the 2 mc end.
5. L4, L5, L6 affect the 15 mc end.

# NOTES


SCHEMATIC
ALC, BLANKING, & METER
900B
R303
150K
P301-7
+275V
R301
470
V305
6922
R302
470
+1V
P301-1
FROM
HORIZONTAL
OUTPUT
S301-1
P302-1
P302-6
+3V
S301-6
R304
50K
CW
M301
100UA
VHF METER
CALIBRATE
S301-5
P302-5
R28
50K
CW
ZERO SET
FRONT PANEL
P302-2
S301-2
R306
180K
P301-6
-275V
R328
150K
P301-5
-150V
S301-4
P302-4
FRONT PAN
METER
ZERO
SWII
VHF
ALC
DET
UHF
ALC
DET
METER AMP
S6-2
P4-2
P3-4
S302-4
R333
100K
UHF METER
CALIBRATE
P301-7
P301-11
P20
TO J20
P4-4
S6-4
P4-3
S6-3
RLY3
+275V
+ SUPPLY TO
FIXED OSC
UHF
+1V
R315
1K
P4-1
S6-1
P3-3
S302-3
VHF
P301-10
FROM
SW2A
R313
100K
RELAY CONNECTS UHF WHEN OPEN
P3-2
S302-2
R317
180K
+4V
R314
100K
R319
5K
-150V
ALC
BIAS
ALC
GAIN
R318
180K
+4V
P301-2
P301-5
6.3AC
BAL
TO
GND
V301
V302
V303
V304
V305
V306
P301-3
RF
OUTPUT
FRONT
PANEL
S11-4
P301-4
R316
1K
+1V
C305
1MFD
861-383D






NOTES:

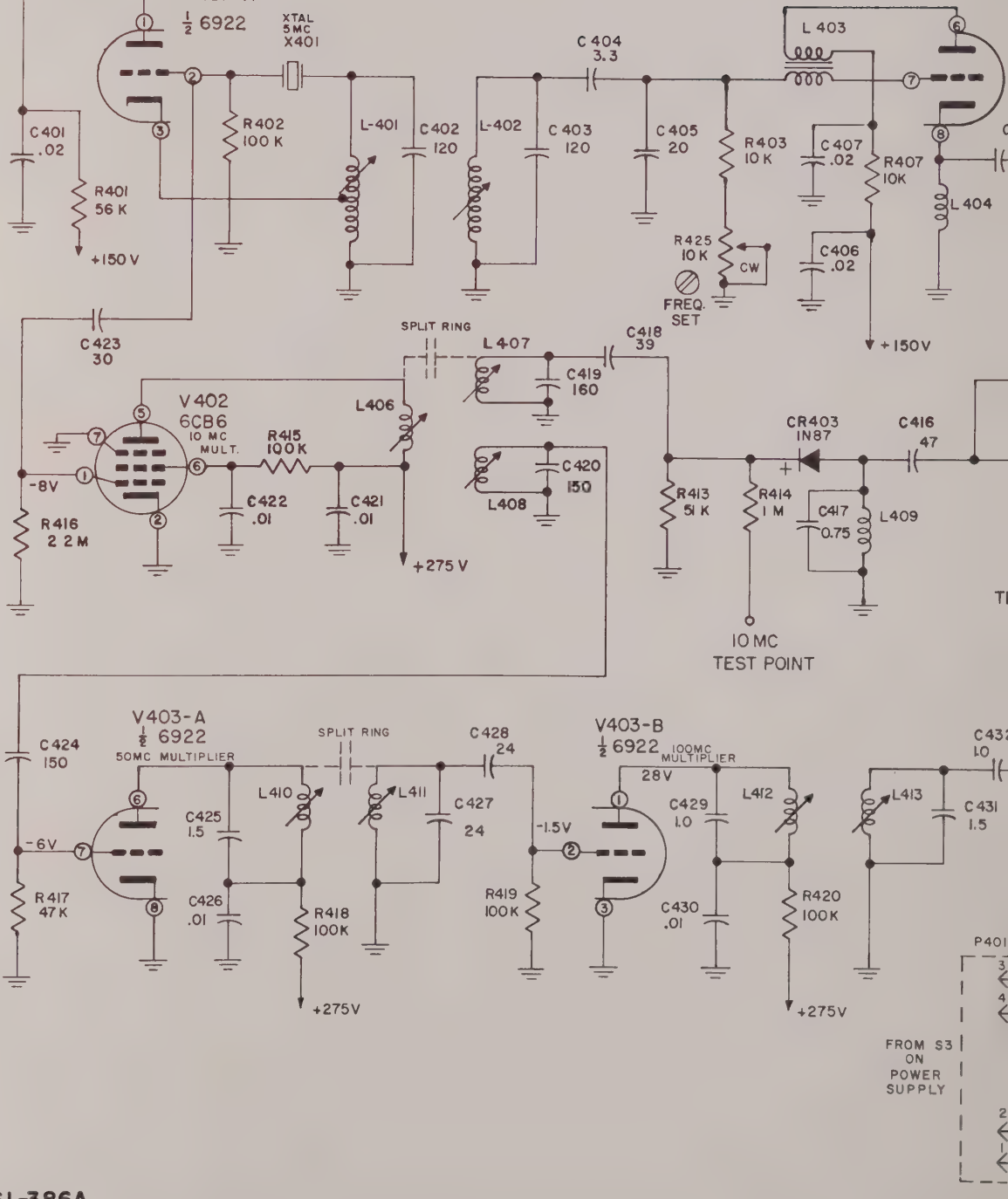
1. ALL RESISTOR VALUES IN OHMS, 1/2 WATT, UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITOR VALUES IN PF, UNLESS OTHERWISE SPECIFIED.
3. * SEE ALIGNMENT INSTRUCTIONS BEFORE ADJUSTING R304 & R333.

Dwg. No. 861-383—ALC, Blanking, and Meter Amplifiers, Schematic Diagram

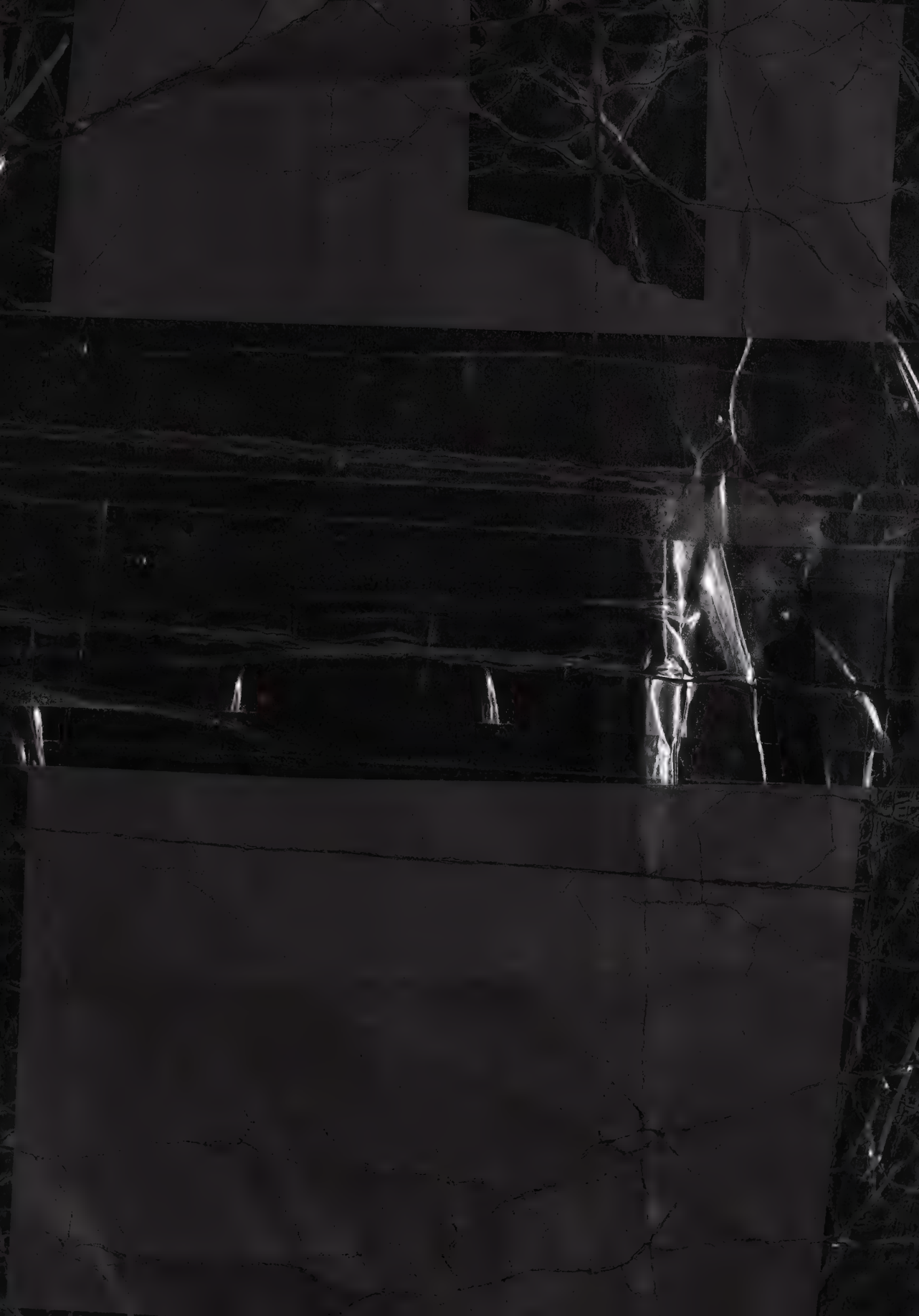
# NOTES

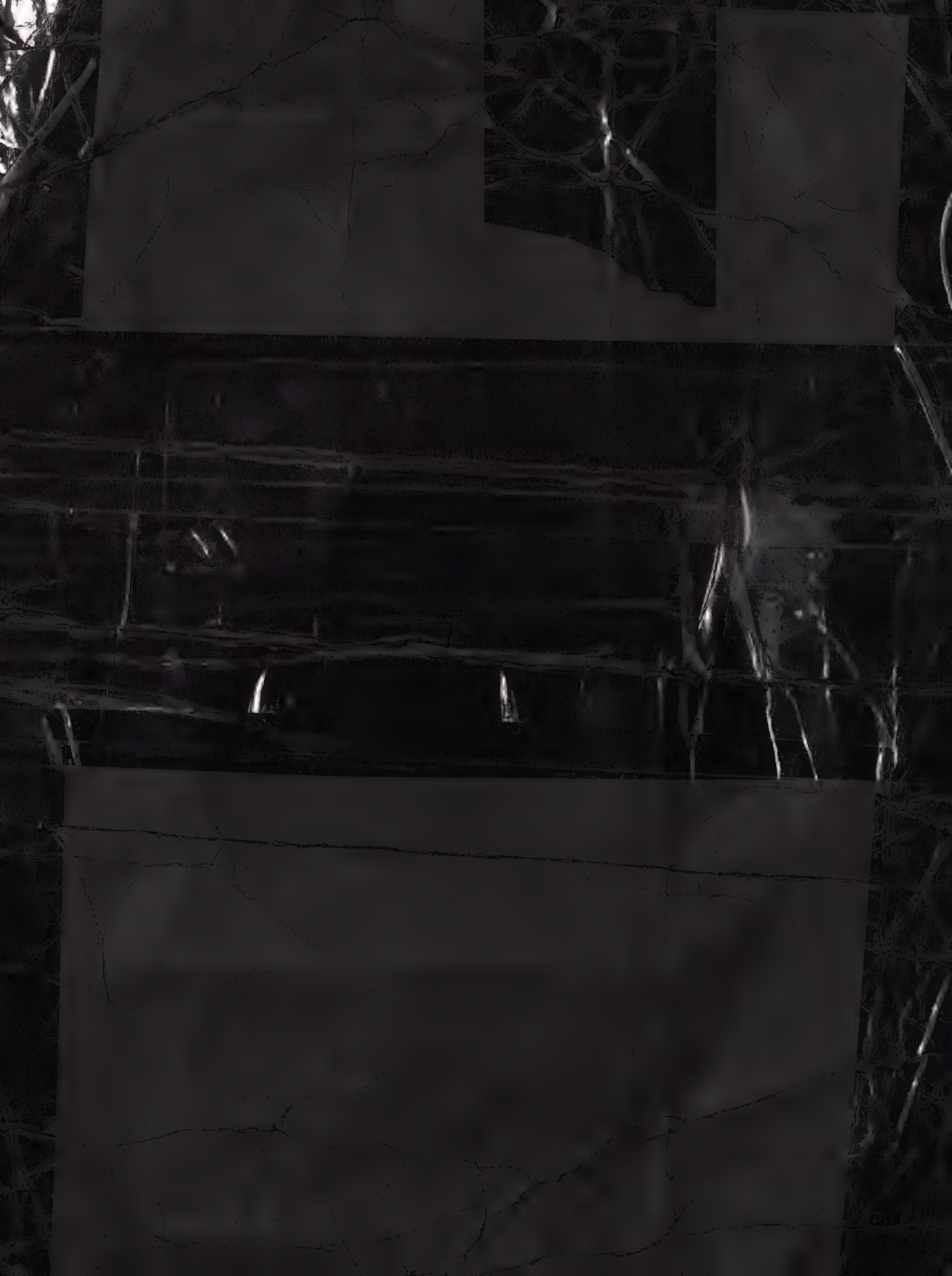
# SCHEMA

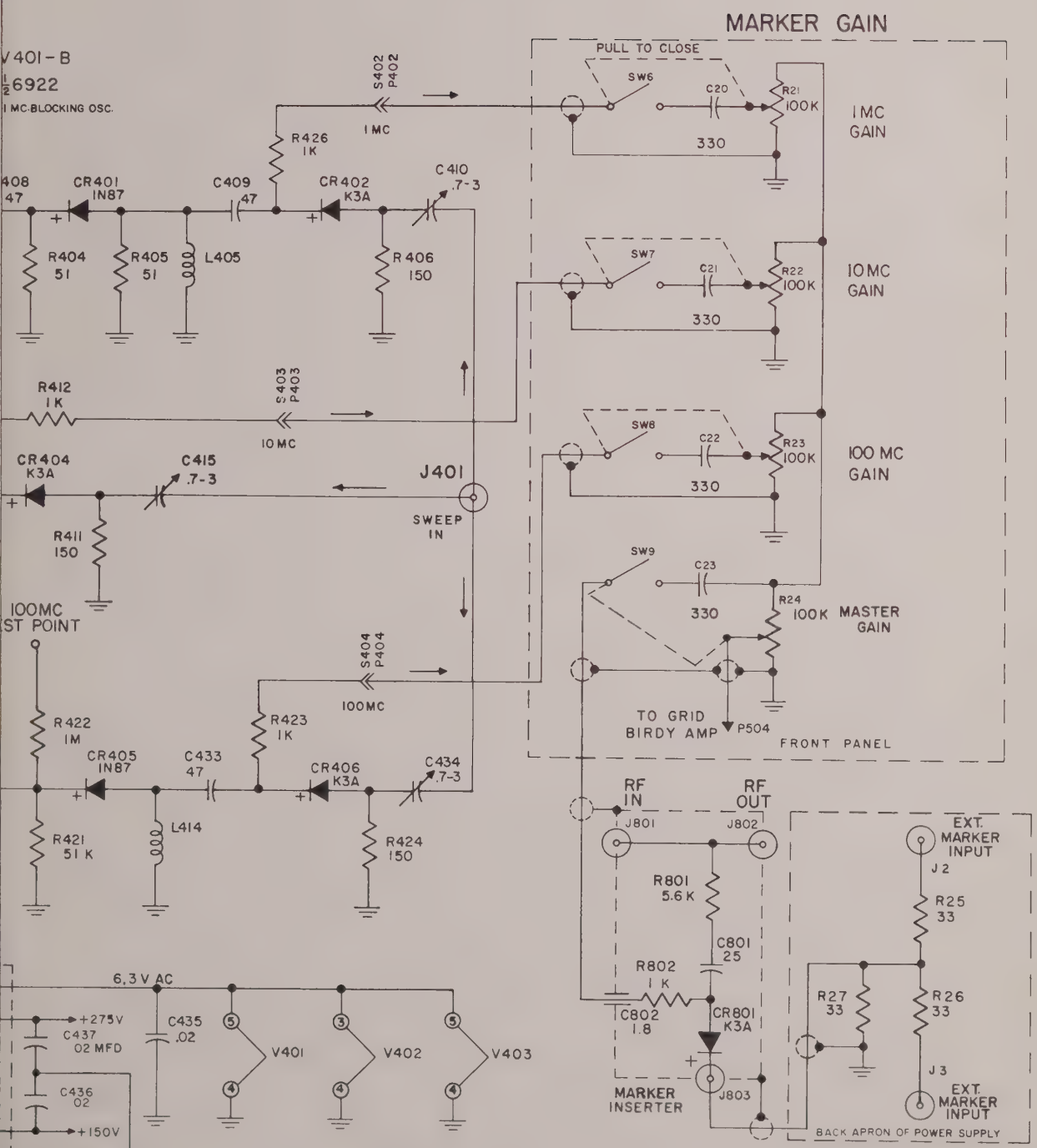
HARMONIC MAR
900 B




861-386A



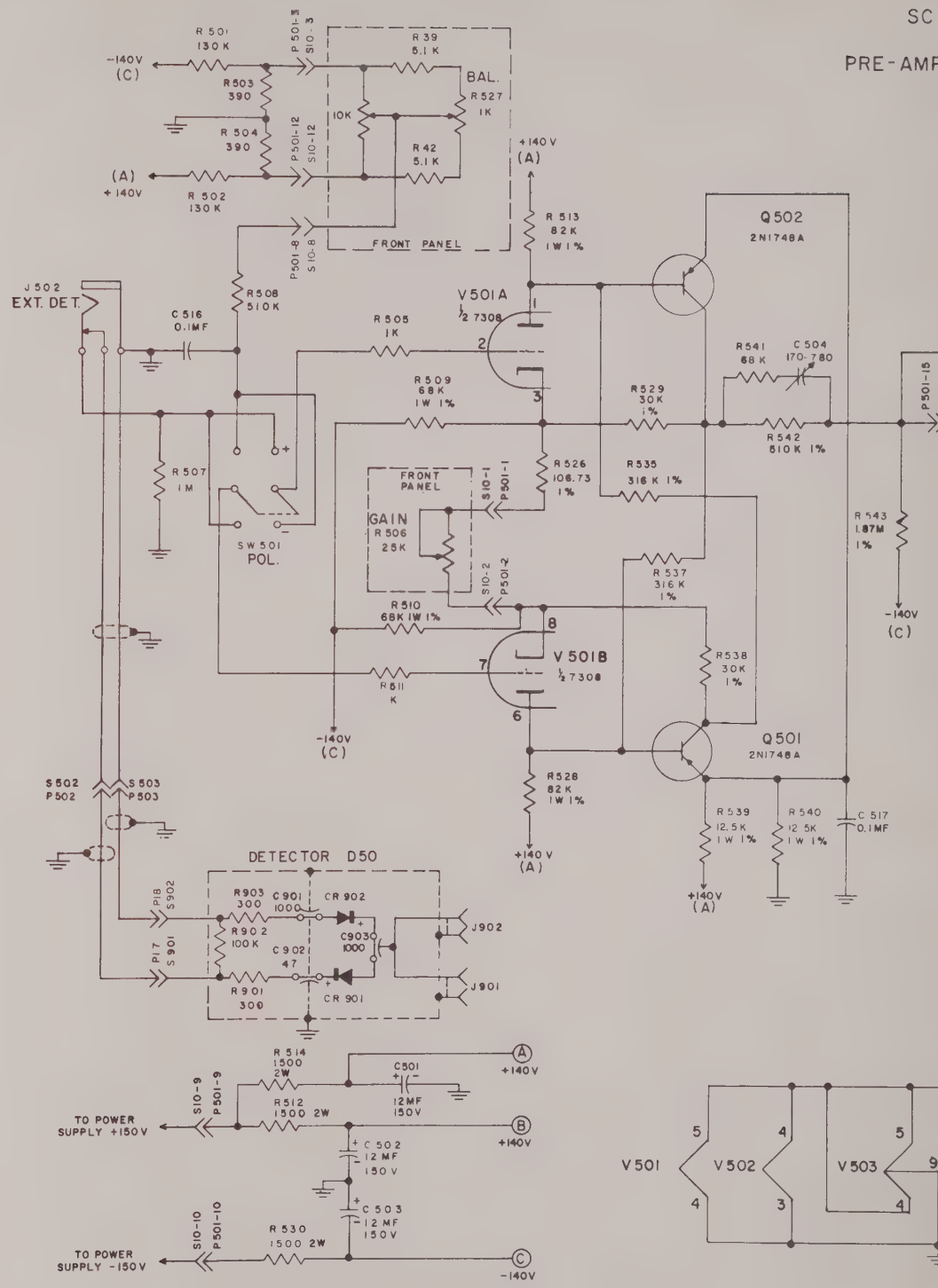




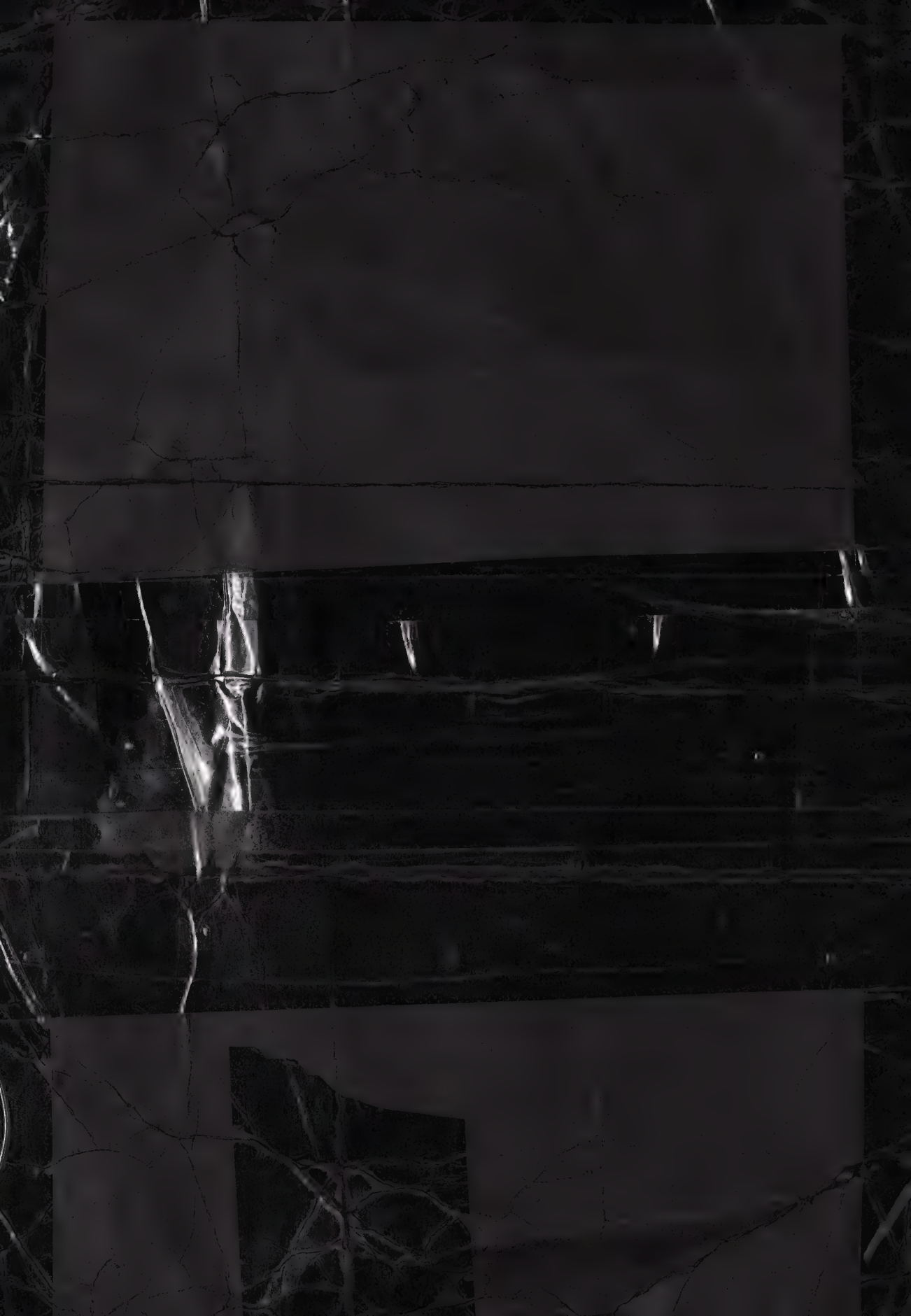

NOTES:
1. ALL RESISTOR VALUES IN OHMS, 1/2 WATT, UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITOR VALUES IN PF, UNLESS OTHERWISE SPECIFIED.

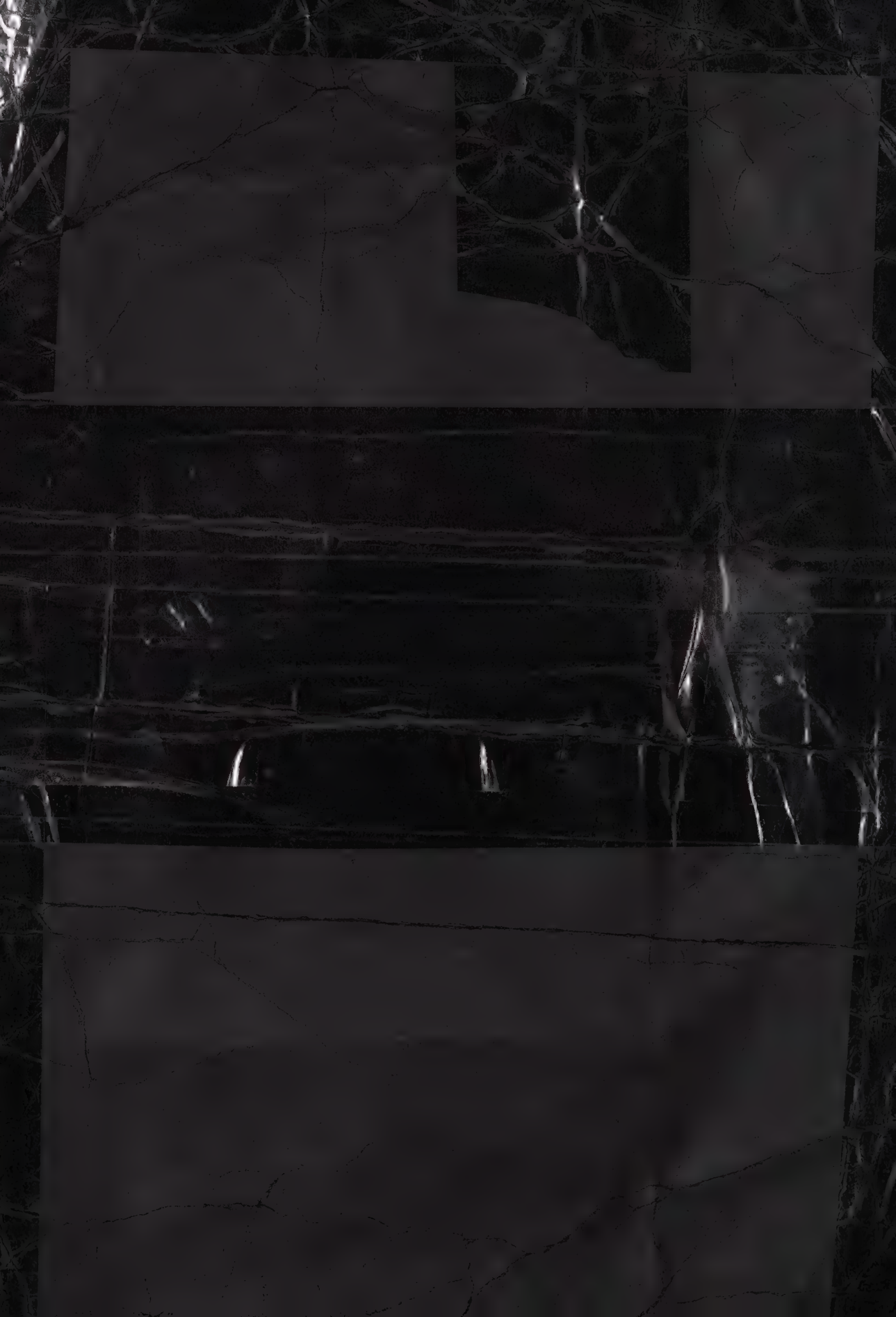
Dwg. No. 861-386—Harmonic Marker Generator, Schematic Diagram

# NOTES




DWG. NO. E 861-387 REV. B

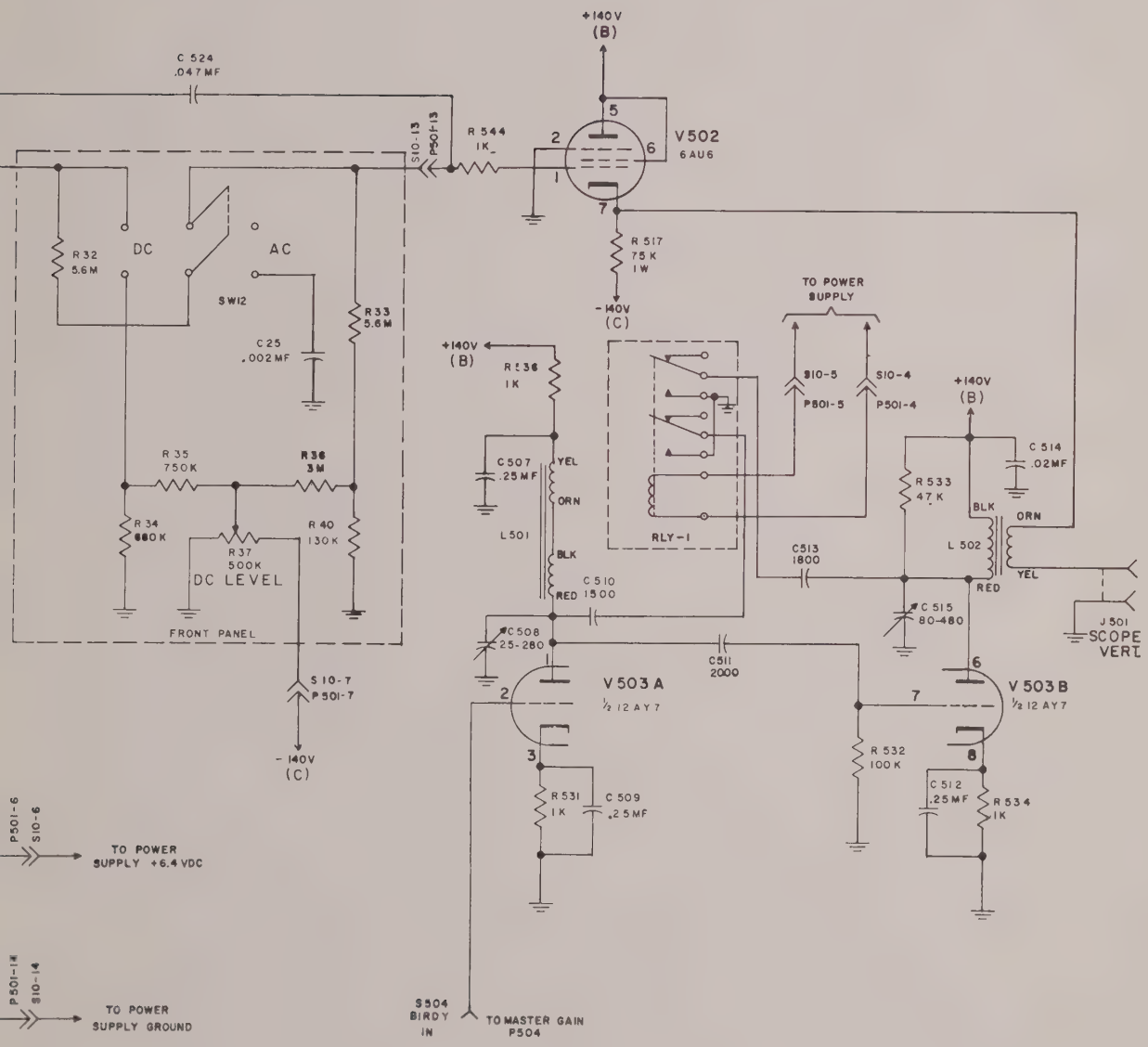




EMATIC

& BIRDY AMP

900B

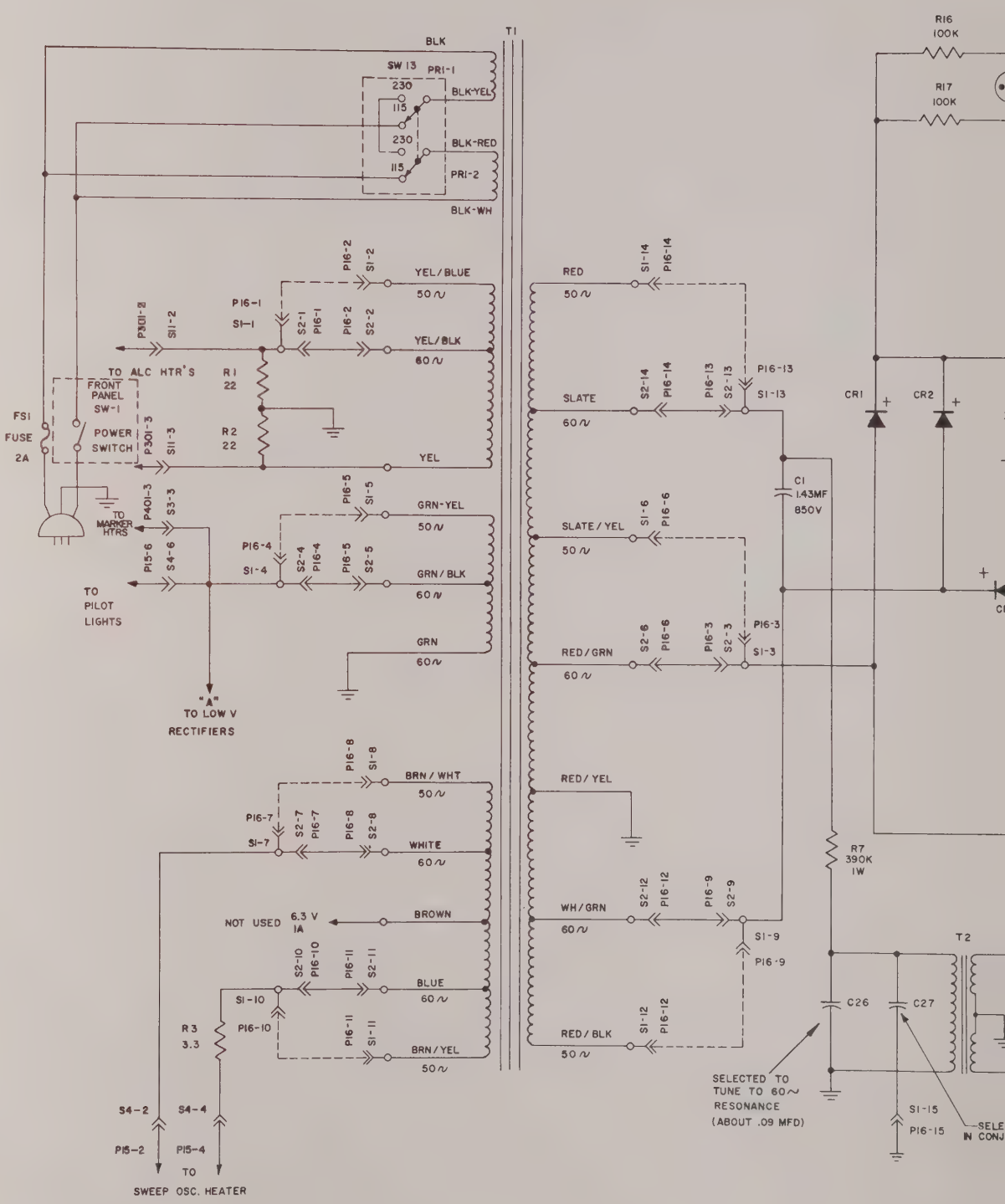


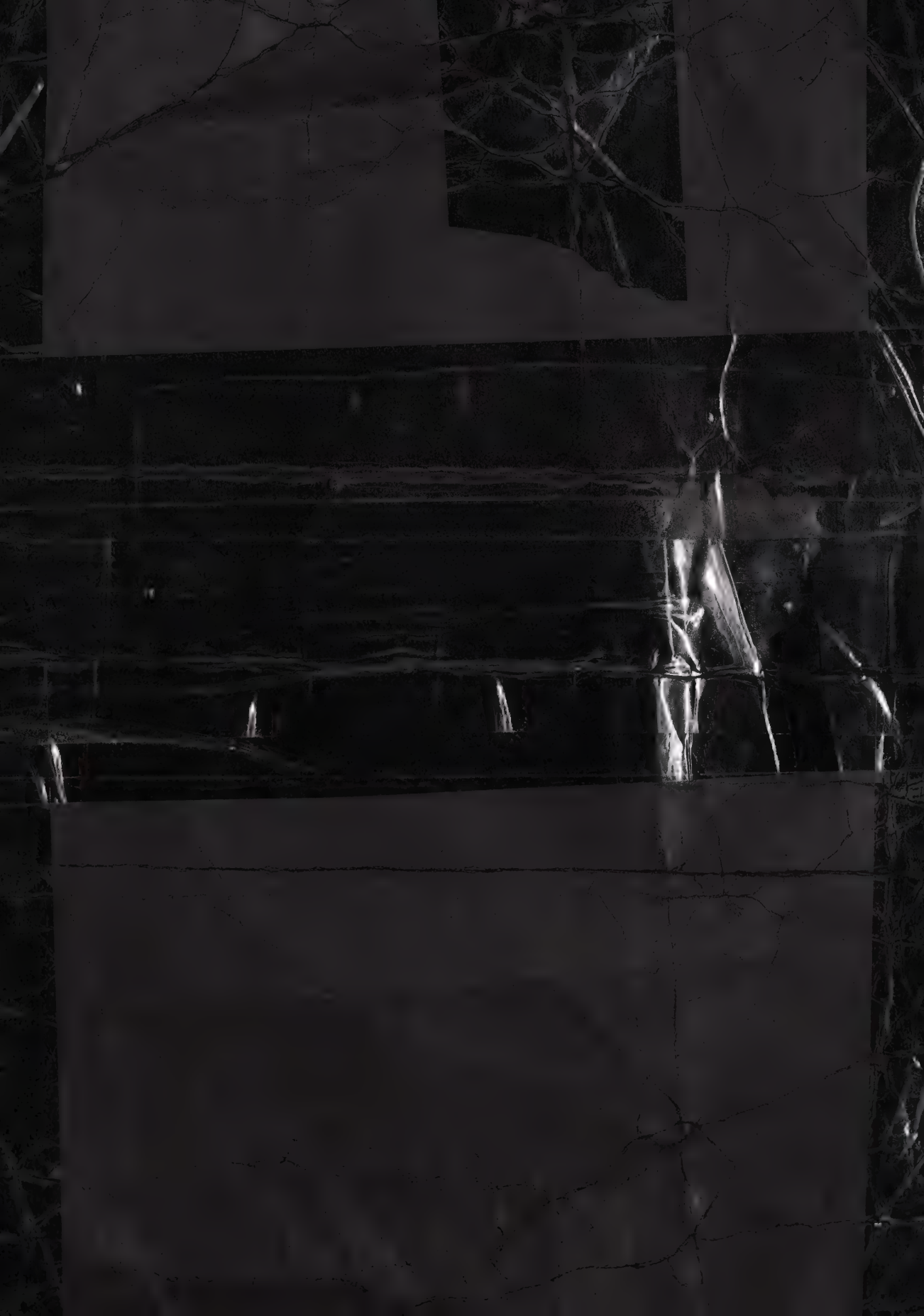

NOTES:

1. ALL RESISITOR VALUES IN OHMS, 1/2 WATT, UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITOR VALUES IN PF UNLESS OTHERWISE SPECIFIED.

Dwg. No. 861-387—Preamplifier and Marker Amplifier, Schematic Diagram

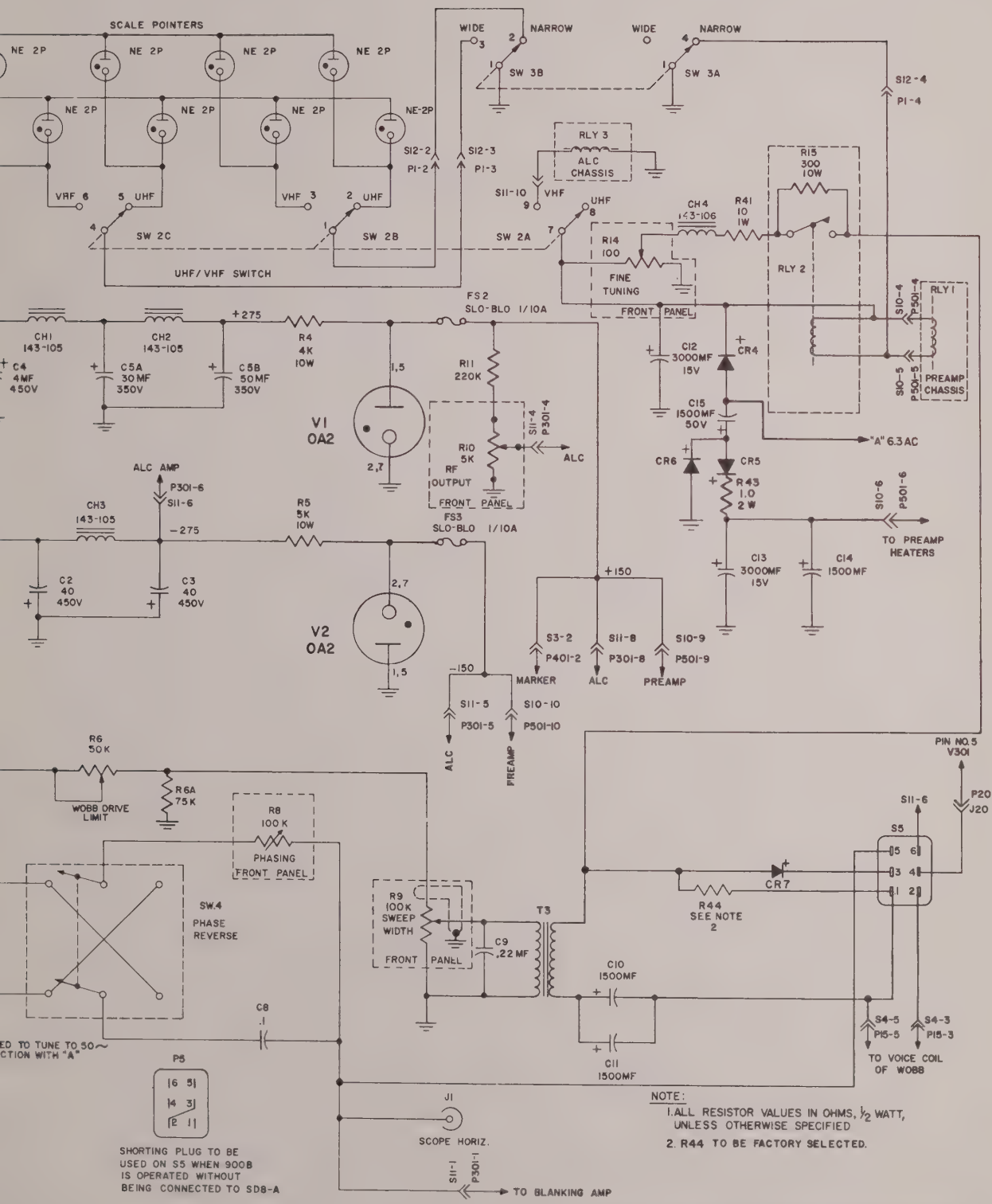
# NOTES


T1
BLK
SW 13
PRI-1
230
115
BLK-YEL
230
115
BLK-RED
PRI-2
BLK-WH
P16-2
S1-2
YEL/BLUE
50 ~
P16-1
S1-1
S2-1
P16-1
P16-2
S2-2
YEL/BLK
60 ~
P301-2
S11-2
TO ALC HTR'S
R1
22
FRONT PANEL SW-1
FS1
FUSE
2A
POWER SWITCH
P301-3
S11-3
R2
22
YEL
P401-3
S3-3
TO MARKER HTRS
P16-5
S1-5
GRN-YEL
50 ~
P15-6
S4-6
P16-4
S1-4
S2-4
P16-4
P16-5
S2-5
GRN/BLK
60 ~
TO PILOT LIGHTS
GRN
60 ~
"A" TO LOW V RECTIFIERS
P16-8
S1-8
BRN/WHT
50 ~
P16-7
S1-7
S2-7
P16-7
P16-8
S2-8
WHITE
60 ~
NOT USED
6.3 V 1A
BROWN
S2-10
P16-10
P16-11
S2-11
BLUE
60 ~
S1-10
P16-10
R3
3.3
P16-11
S1-11
BRN/YEL
50 ~
S4-2
S4-4
P15-2
P15-4
TO SWEEP OSC. HEATER
RED
50 ~
S1-14
P16-14
SLATE
60 ~
S2-14
P16-14
P16-13
S2-13
P16-13
S1-13
SLATE/YEL
50 ~
S1-6
P16-6
RED/GRN
60 ~
S2-6
P16-6
P16-3
S2-3
P16-3
S1-3
RED/YEL
WH/GRN
60 ~
S2-12
P16-12
P16-9
S2-9
S1-9
P16-9
RED/BLK
50 ~
S1-12
P16-12
SELECTED TO TUNE TO 60 ~ RESONANCE (ABOUT .09 MFD)
C1
1.43MF
850V
R16
100K
R17
100K
CR1
CR2
R7
390K
1W
T2
C26
C27
S1-15
P16-15
SELE
IN CONJ



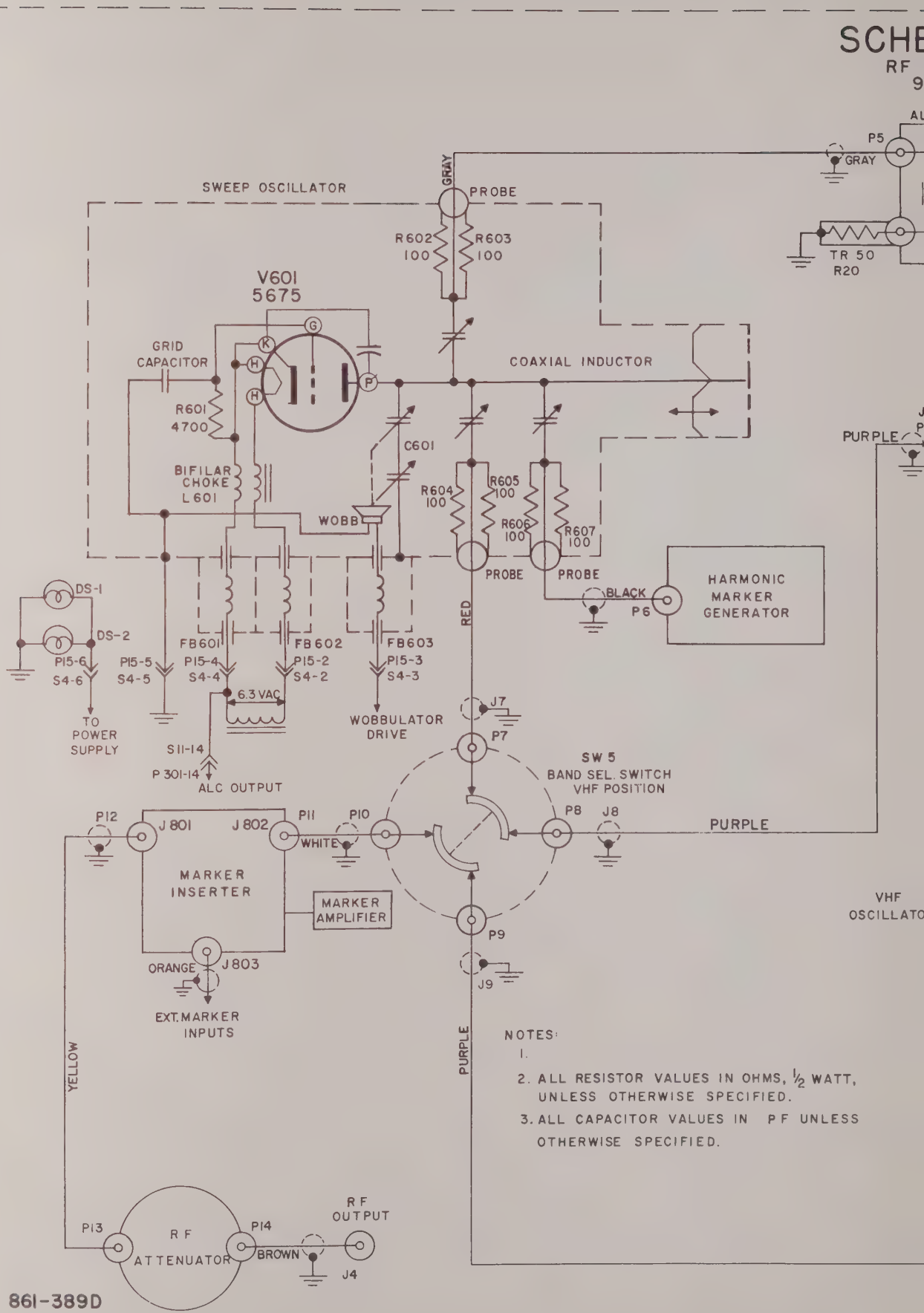
MATIC

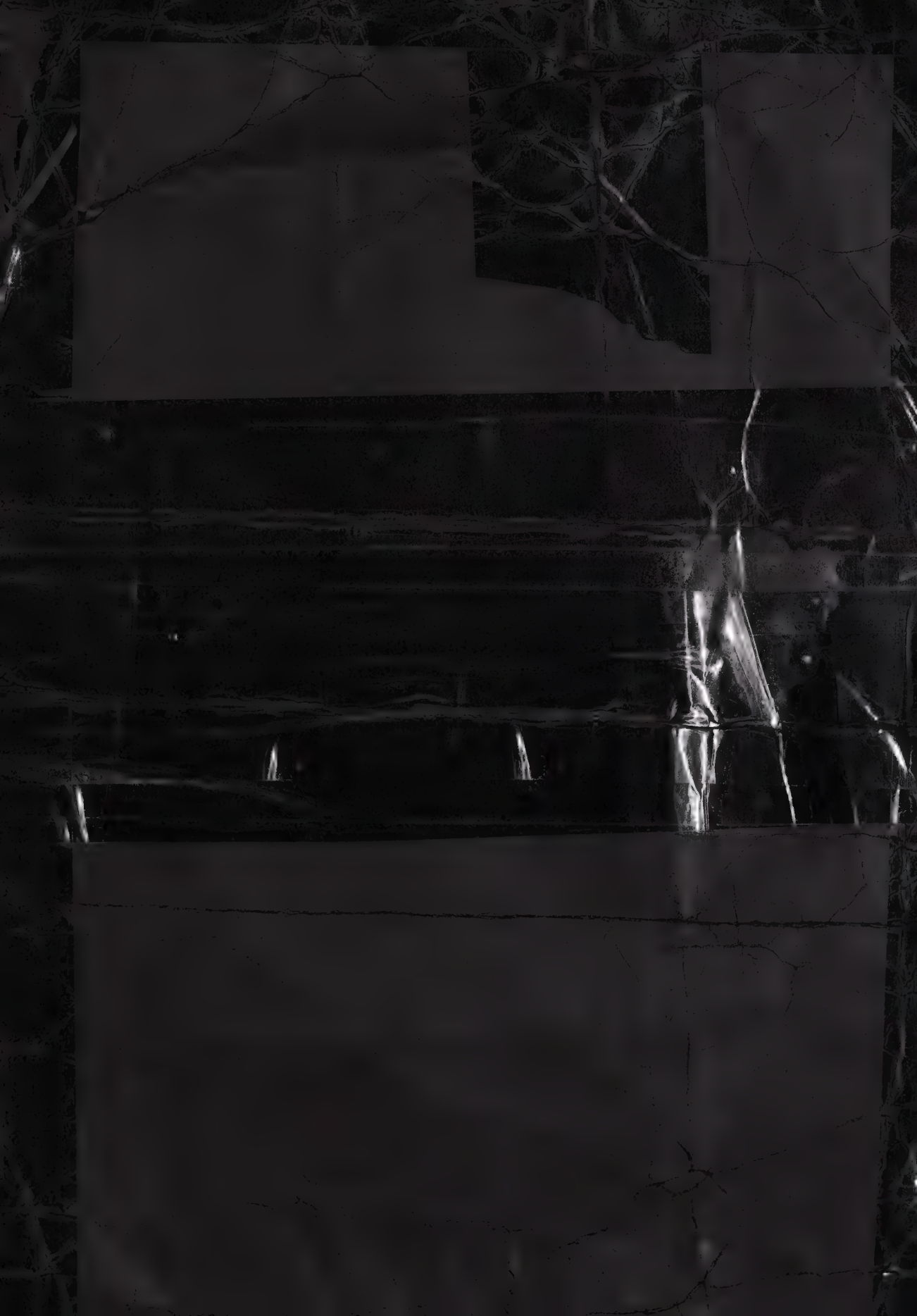
SUPPLY

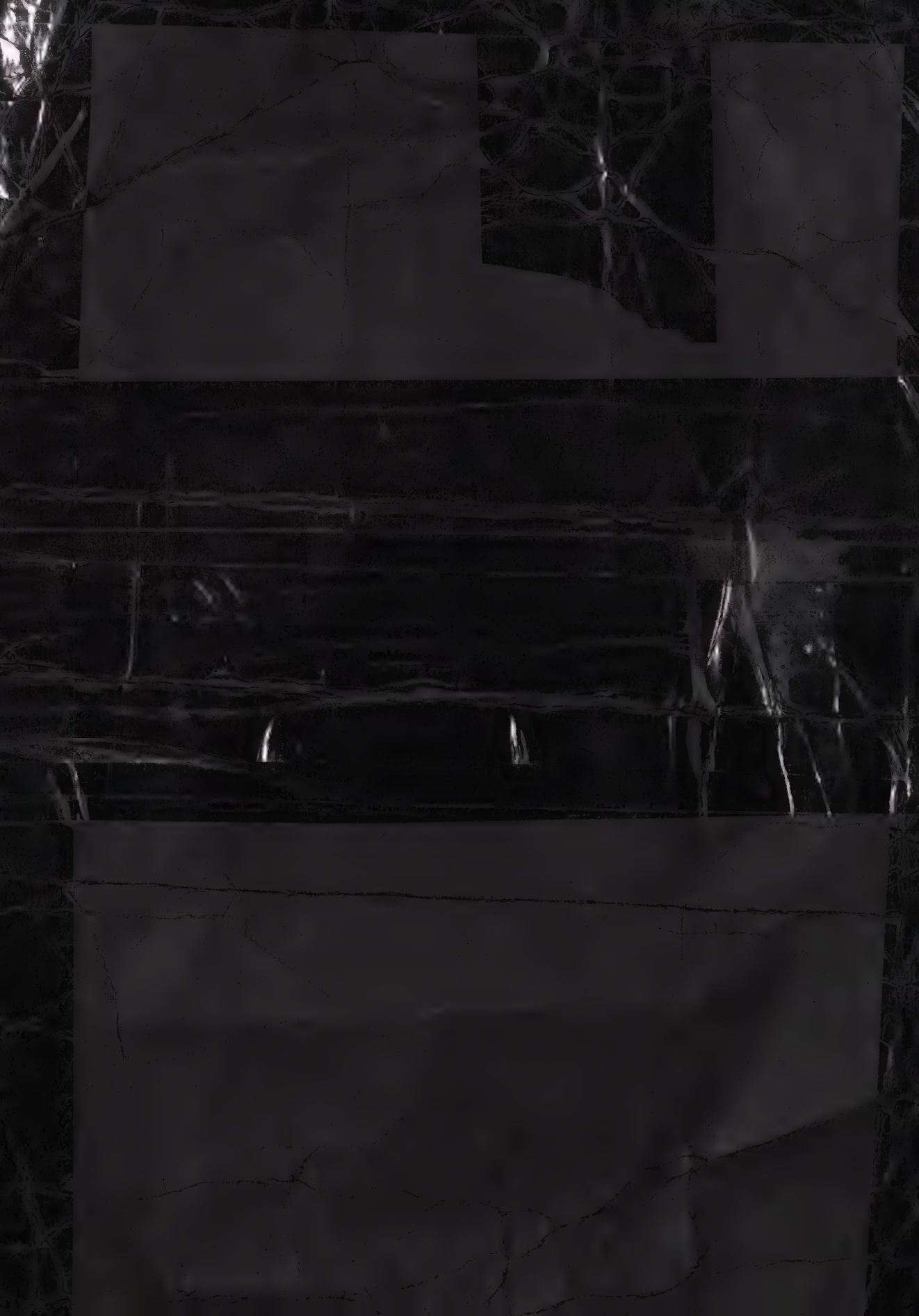


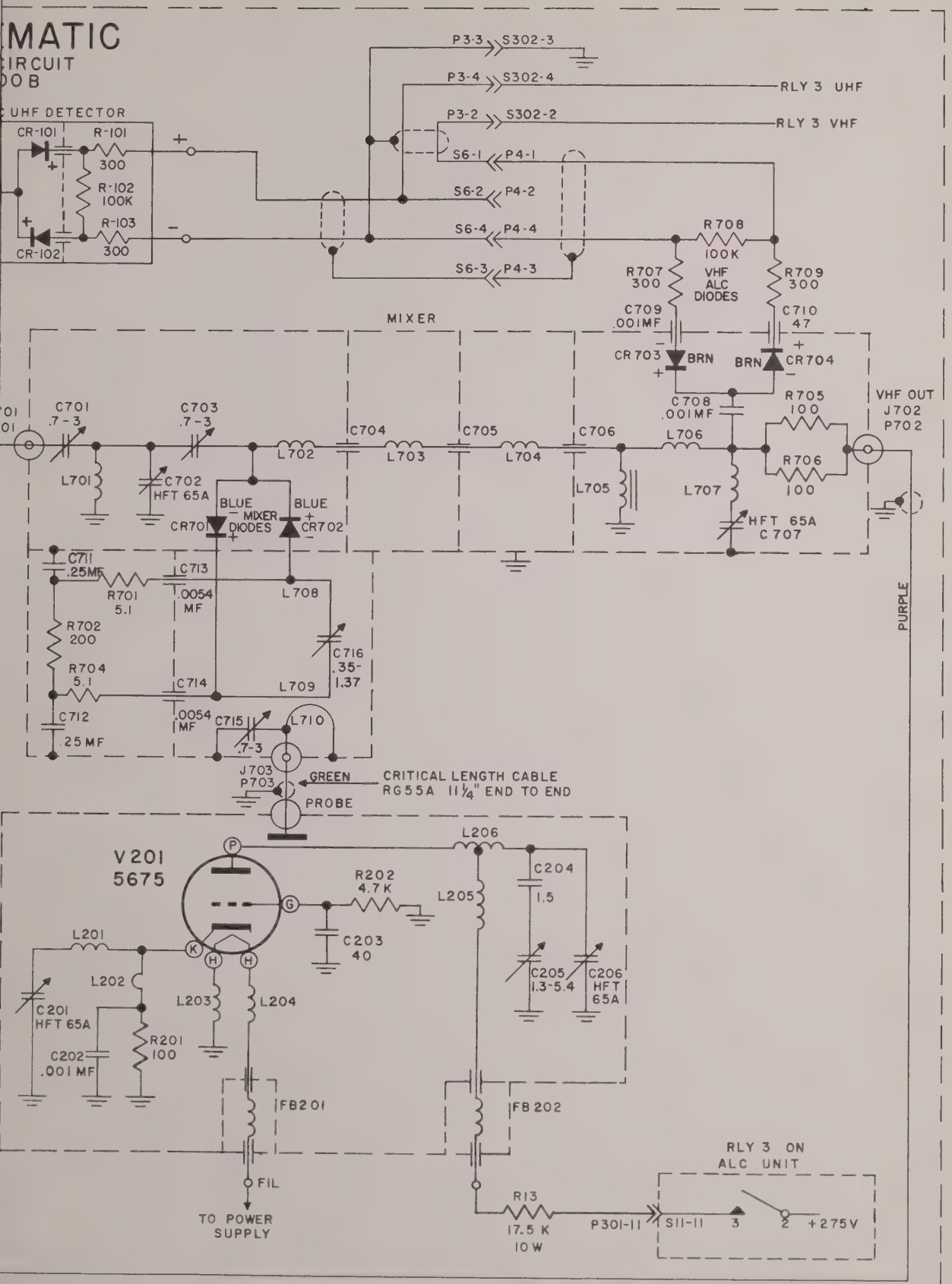

Dwg. No. 861-388—Power Supply, Schematic Diagram

# NOTES


SCHE
RF
9
SWEEP OSCILLATOR
PROBE
GRAY
R602
100
R603
100
V601
5675
G
K
H
H
P
GRID
CAPACITOR
R601
4700
BIFILAR
CHOKE
L601
C601
WOBB
COAXIAL INDUCTOR
R604
100
R605
100
R606
100
R607
100
PROBE
PROBE
BLACK
P6
HARMONIC
MARKER
GENERATOR
P5
GRAY
TR 50
R20
PURPLE
DS-1
DS-2
P15-6
S4-6
P15-5
S4-5
FB601
P15-4
S4-4
FB602
P15-2
S4-2
FB603
P15-3
S4-3
6.3 VAC
TO
POWER
SUPPLY
S11-14
P 301-14
ALC OUTPUT
WOBBULATOR
DRIVE
RED
J7
P7
SW 5
BAND SEL. SWITCH
VHF POSITION
P12
J 801
J 802
P11
P10
WHITE
P8
J8
PURPLE
MARKER
INSERTER
MARKER
AMPLIFIER
P9
J9
ORANGE
J 803
EXT. MARKER
INPUTS
YELLOW
PURPLE
VHF
OSCILLATO
NOTES:
1.
2. ALL RESISTOR VALUES IN OHMS, 1/2 WATT, UNLESS OTHERWISE SPECIFIED.
3. ALL CAPACITOR VALUES IN PF UNLESS OTHERWISE SPECIFIED.
P13
R F
ATTENUATOR
P14
BROWN
J4
R F
OUTPUT
861-389D








Dwg. No. 861-389—R-F Circuits, Schematic Diagram

JERROLD

# Technical Newsletter

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## NEW ATTENUATOR AND COMPARATOR

# EXTEND FREQUENCY RANGE OF COMPARISON TECHNIQUE TO 1200 MC.

Fig. 2—Model ATV-109R Rack-Mounting Bank of Turret Attenuators

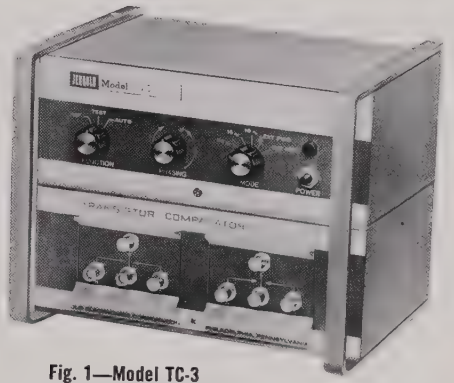



Fig. 1—Model TC-3 Coaxial Comparator

**SUMMARY: A new drum attenuator and a transistorized three-way coaxial comparator are described, which allow accurate sweep-frequency measurements of transmission loss, gain, and reflection coefficient in 50-ohm coaxial systems from DC to 1200 MC.**

## INTRODUCTION

For the past six years, Jerrold has been offering as accessories to the 900-A and 900-B Sweep-Frequency Generators a comparator (high speed coaxial switch Model FD-30) and variable attenuators (Model AV-50). When used with a wide-band sweep-frequency generator these allow quite accurate measurements of transmission gain and loss[1], and when used with a suitable bridge, measurement of reflection coefficient (return loss)[2] to a limit of accuracy determined by the characteristics of these accessories. The FD-30 Comparator and the AV-50 Attenuator were originally designed for use in the frequency-range up to 250 MC, where they had excellent characteristics, with reasonably good performance up to 500 MC. Since the Model 900 Sweep Generators provide coverage up to 1200 MC there has been a need for improved accessories, making the comparison technique available up to the limit of the sweep capability.

The new Model TC-3 Transistorized Comparator and the Model ATV Turret Attenuators have been developed to meet this need. They provide measurement accuracy up to 1200 MC, somewhat better than that obtained with the older equipment up to 250 MC, and in addition feature several marked improvements in operating convenience over the older equipment.

1. Jerrold Technical Newsletter Volume 2, Number 1—March 1964. COMPARISON TECHNIQUE IMPROVES SWEEP FREQUENCY MEASUREMENTS. Ken Simons, Jerrold Electronics Corporation.

2. Jerrold Technical Newsletter Volume 1, Number 4—August 1960. A BRIDGE METHOD OF SWEEP FREQUENCY IMPEDANCE MEASUREMENT. (Same author.)

Figure 1 shows the Model TC-3 Coaxial Comparator. It consists of two basic housings arranged so that they can be mounted one on top of the other to form a convenient package for bench-mounting, or mounted side-by-side to form a 3½″ high panel in a standard 19″ rack. One of the units houses the transistor driver and the controls; the other houses the two coaxial switch assemblies. Each switch assembly consists of three reed relays mounted to form a single-pole triple-throw coaxial switch.

At frequencies in the gigacycle region, jumper cables present a major limitation on the accuracy of measurements. Therefore, accuracy is greatly improved if jumper lengths are kept to an absolute minimum. For this reason each assembly switch has been designed so that it can be removed from the housing and extended on a long cable so that it can be placed immediately adjacent to the units being tested. The reed relays operate equally well in any position; thus the switching heads can be positioned to suit the physical position of the units under test.

The operation of the new comparator can best be explained by comparing it with the FD-30. Figure 3a illustrates application of the FD-30 to the measurement and display of the frequency response of a resonant network. The sequence of operations when the unit is used with a 60-cycle supply is illustrated in Figure 3b and the resulting scope trace is shown in Figure 3c. Note that the complete cycle occurs in one-thirtieth of a second, and that the zero line is traced out twice in each cycle.

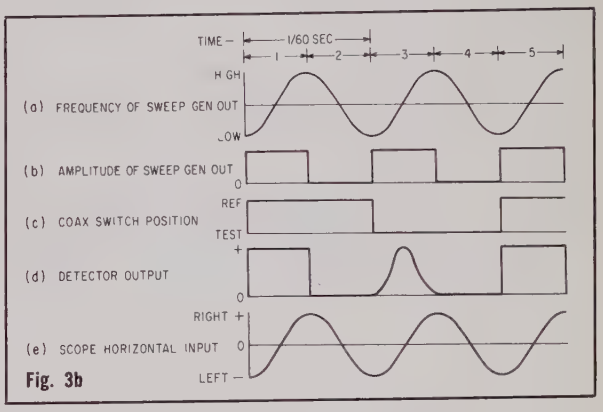



Fig. 3b

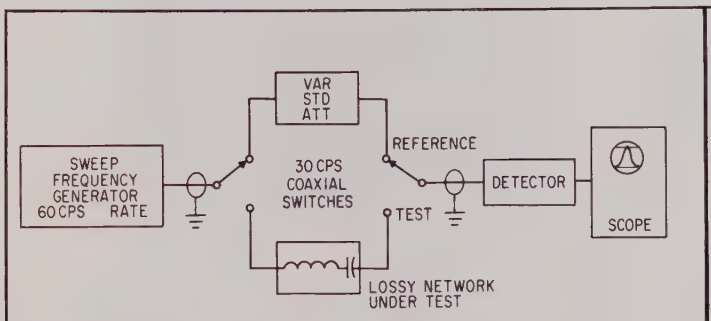



Fig. 3a—Operation of 2-Way Comparator Model FD-30

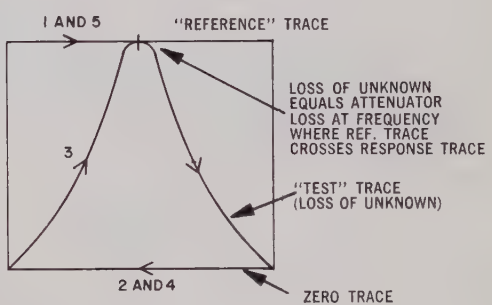

1 AND 5
"REFERENCE" TRACE
LOSS OF UNKNOWN EQUALS ATTENUATOR LOSS AT FREQUENCY WHERE REF. TRACE CROSSES RESPONSE TRACE
3
"TEST" TRACE (LOSS OF UNKNOWN)
2 AND 4
ZERO TRACE

Fig. 3c

Figure 4a illustrates the application of the three-way comparator using two attenuators to show simultaneously the maximum response and the 3 db down point of a resonant circuit on an oscilloscope. Figure 4b diagrams the sequence of operations. Note that the switches "A" close during the first quarter cycle, connecting attenuator "A" into the circuit; switches "B" close during the next quarter cycle connecting attenuator "B" into the circuit; during the third quarter cycle, switches "C" close, connecting the unknown; and all switches are open during the fourth quarter cycle, producing the zero base line. The resulting scope trace is shown in Figure 4e. The response curve is displayed with a zero base line and two reference lines. The position of the reference lines on the trace corresponds to the attenuation of two separate attenuators.

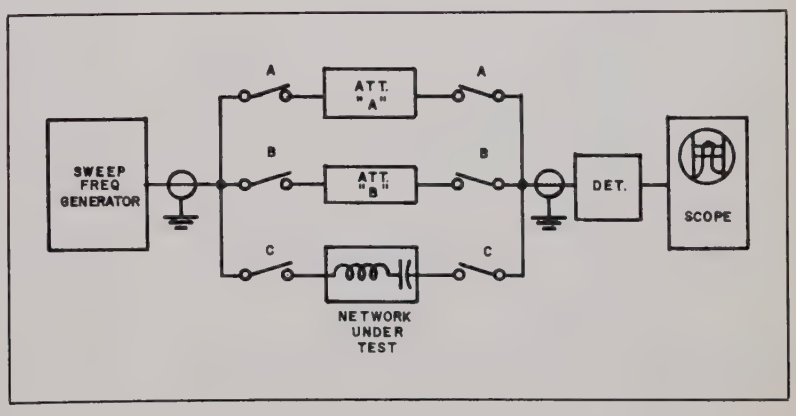



Fig. 4a
Operation of
3-Way Comparator
Model TC-3

This three-way display allows, for example, setting up a production test position with high and low limits of gain, loss, or impedance, keyed into the scope so that all calibrations are independent of generator output or scope drift.

Figure 5 shows a block diagram of the transistor driver employed to obtain this operation. With the input switch in INT position, the synchronizing input is obtained from a 60-cycle AC connection to the power supply through a 360° phase shifter. With the switch on EXT, an external synchronizing input may be used at any frequency between zero and several hundred cycles. A source capable of supplying six volts peak-to-peak into 20,000 ohms is required. Regardless of the input wave form, the switches will operate about one millisecond after each zero volt cross-over.

The internal or external synchronizing signal is shaped by a Schmitt trigger and clipper and the resulting square wave, which has the same frequency as the synchronizing source, is applied to a two-to-one counter generating a square wave at ½ that frequency. Both square wave voltages are applied to a diode AND gate, which controls the input to three driver transistors so that these are keyed in the sequence required to drive the relay coils. A function switch selects one of three switching mode connections to the driver transistors so that relay switching can be performed either: manually, or by three-way automatic switching, or by two-way automatic switching giving operation similar to the FD-30.

Three reed relays are used in each of two heads, mounted coaxially to obtain the best possible impedance match up to 1200 MC. The impedance match, when the switch is terminated in a precise 50 ohms, is held to a close tolerance as shown by the characteristic in Figure 6. The relay units were selected to give an unusually high degree of isolation when open, and low insertion loss when closed. The insertion loss, when the switch is closed, is less than 0.1 db from DC to 1200 MC. When open, the capacity is less than 0.085 pf giving an insertion loss which decreases with frequency, as shown in Figure 7.

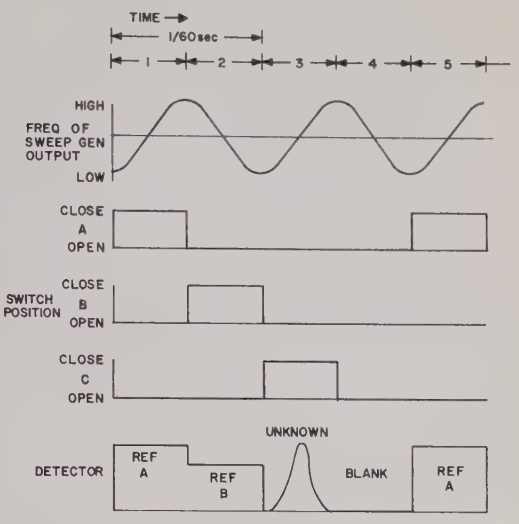


Fig. 4b

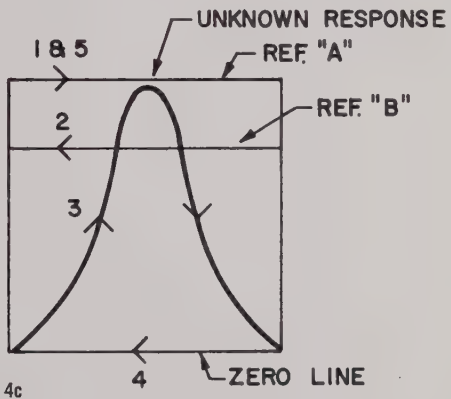


Fig. 4c

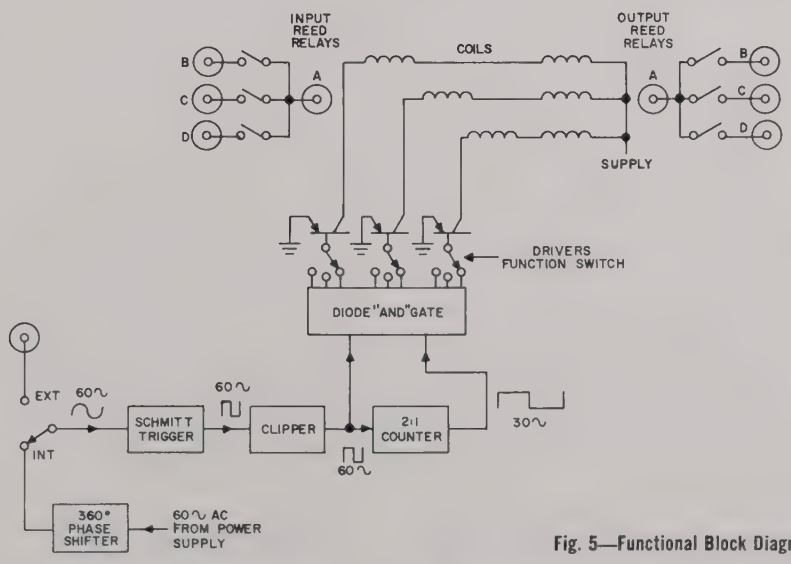


Fig. 5—Functional Block Diagram of Transistor Driver

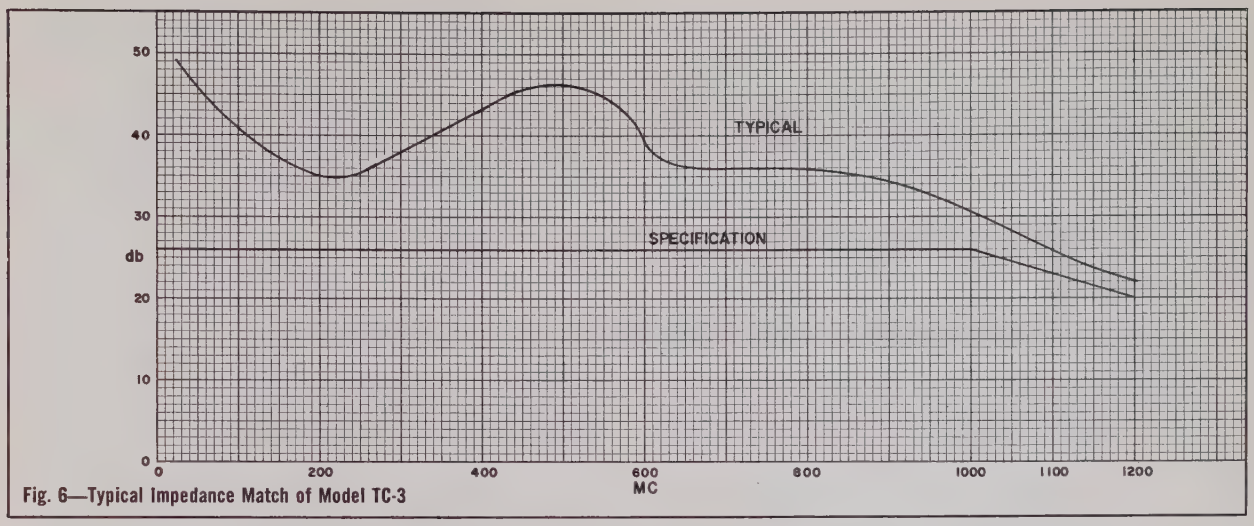


Fig. 6—Typical Impedance Match of Model TC-3

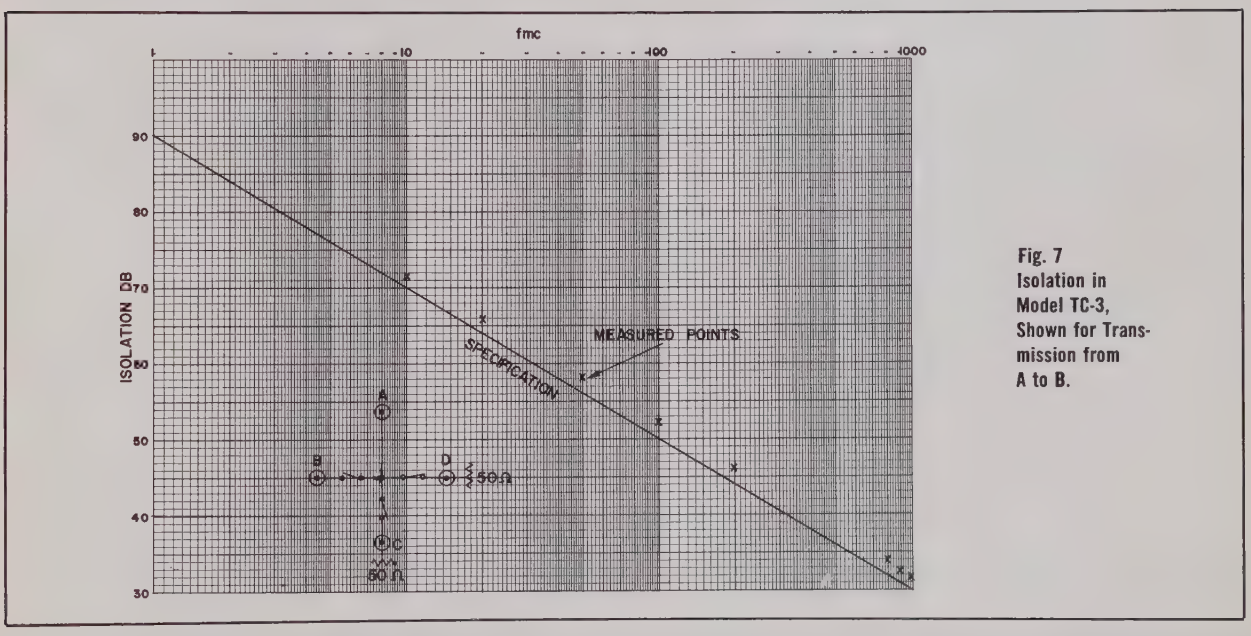


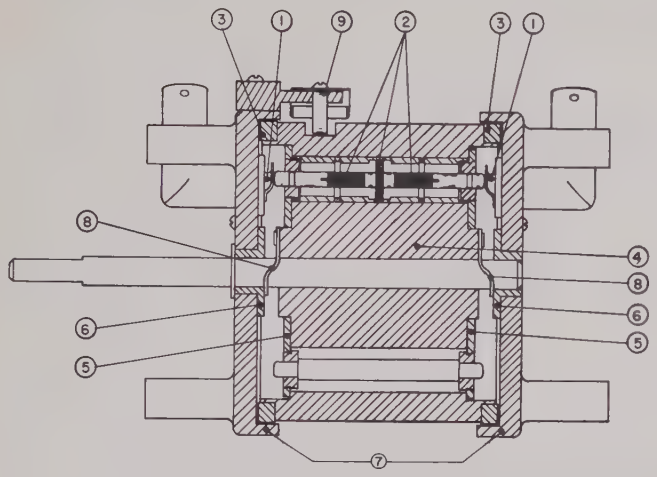
Fig. 7
Isolation in
Model TC-3,
Shown for Trans-
mission from
A to B.

## MODEL ATV ATTENUATORS

The design selected for the new attenuators strikes a happy compromise between two extremes. Variable attenuators available today fall into two general categories. The best commercially available units are drum attenuators with an upper frequency limit of 2 to 4 GC. Several of the available types are pull-and-turn mechanisms which have optimum electrical performance at the expense of mechanical convenience. Prices are in the vicinity of $750 to $800 for a 10-position drum. All of the best units use disc and rod assemblies with either deposited carbon or film resistors.

At the other extreme there are many types of less expensive attenuators which cost less than $200. These generally use deposited or molded carbon resistors and various switching arrangements, either the progressively additive type (like our AV-50) or rotary switches. While these are excellent for low frequency applications and have good mechanical convenience, it is very difficult to maintain acceptable performance up to 1 GC with any arrangement where resistive elements are connected into the attenuator with wire leads.

Fig. 2 illustrates a rack-mounting bank of attenuators (Model ATV-109). A cross-section view of a turret is given in Figure 8. The highest quality deposited carbon rod and disc assemblies are used, mounted coaxially to take full advantage of their excellent match and attenuation capabilities. Spring contacts are employed between the attenuator element and the input and output connectors. While this construction does not provide as good a coaxial connection as might be obtained with a pull-and-turn arrangement, with careful design it has been made to give excellent performance to our top frequency objective of 1200 MC. The carefully-machined castings and well-designed detent ensure accurate and trouble-free operation. Complete RF shielding is assured by the use of RF gasketing material. The impedance match characteristics and attenuation accuracy of a typical 0-50 db drum are illustrated in Figures 9 and 10.



1. Coin silver contacts.
2. Disc and rod pad resistors for accuracy and long time-stability. Low VSWR assured with machined compensating sleeves.
3. Resilient rf gasketing for good ground contact and shielding.
4. Solid aluminum rotor, precision machined for accuracy and stability.
5. Important rf grounds carried by silver plated brass rings.
6. Brass bearing inserts for minimum wear.
7. Machined aluminum end castings to maintain alignment.
8. Coin silver inner contact grounding spring (necessary on some models only).
9. Positive spring-loaded ball bearing detent mechanism with faultless resolution.

**Fig. 8—Cross-Section of Turret Attenuator**

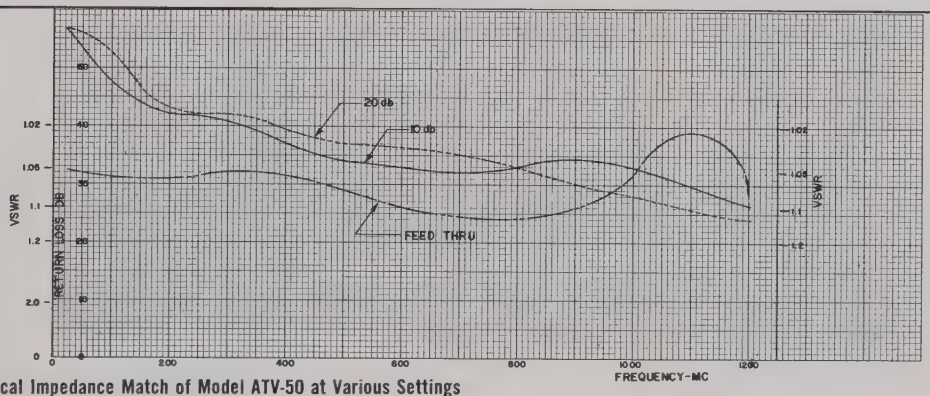



**Fig. 9—Typical Impedance Match of Model ATV-50 at Various Settings**

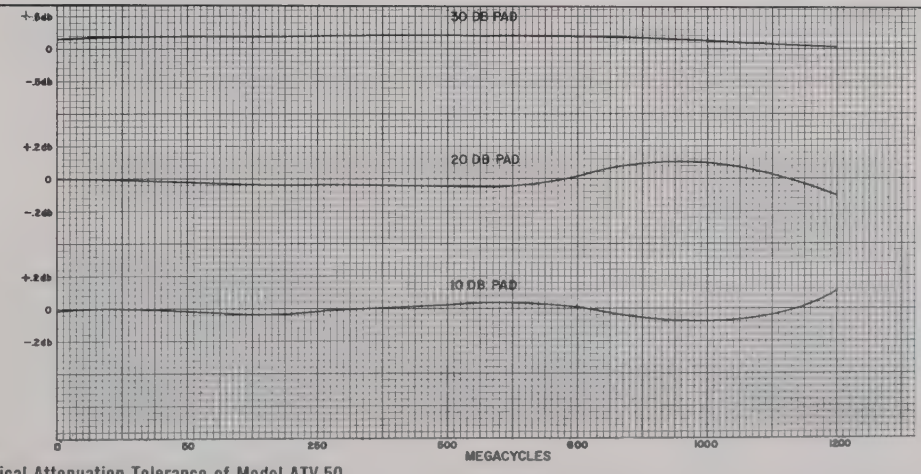



**Fig. 10—Typical Attenuation Tolerance of Model ATV-50**

Design of the attenuators and comparators was carried out under the direction of Henry Arbeiter. He also is responsible for electrical design of the attenuator, working with Eric Winston on mechanical design. John Austin designed the reed-relay heads on the TC-3, Frank Egenstafer is responsible for the transistor driver, and Earl Nickerson for the styling.

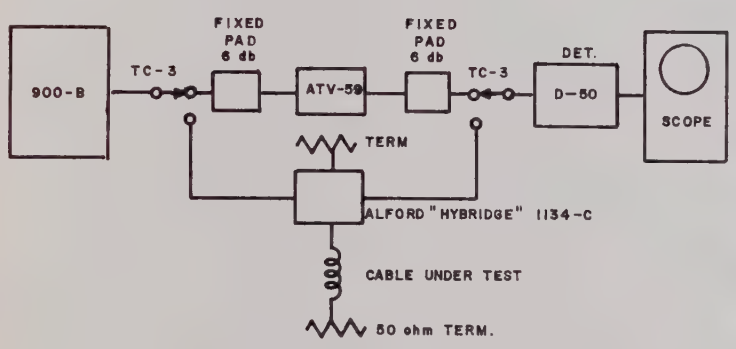
## MODEL 890 WIDE-BAND SWEEPER

Model 890

Latest in Jerrold's proven group of sweep frequency generators is the new, moderately priced Model 890. This sweeper, although somewhat less sophisticated in its design than the Model 900-A, nevertheless incorporates all of that instrument's basic circuitry necessary to permit a highly economical production line test set-up.

Together with the new comparator and attenuators, the 890 will afford fast, repetitive measurements for simultaneous low and high limit comparison. Tests can be made up into the UHF range of 1100 MC, at a top center frequency setting of 1000 MC with a sweep width variable from 100 KC min. to ± 10% of center frequency.

## TYPICAL APPLICATIONS IN MEASUREMENTS BY COMPARISON

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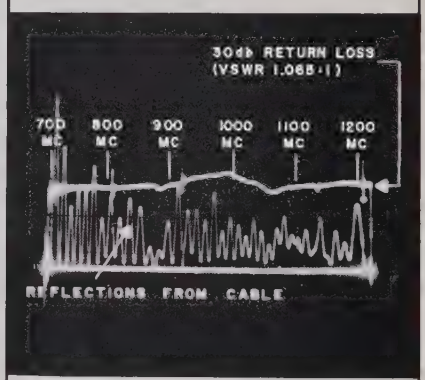
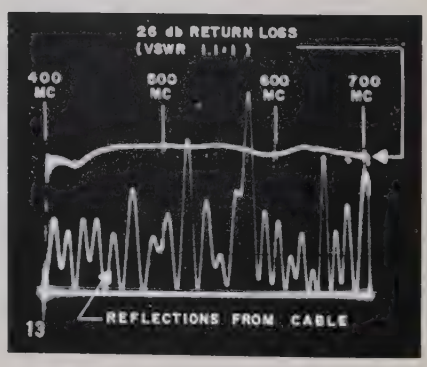



12

Application of Models TC-3 and ATV-50 in testing the impedance characteristics of coaxial cables. The test involved approximately 50 ft. of type RG-8A/U flexible coaxial cable, carefully terminated at the other end. Photo 12 illustrates the trace for measurement between 700 and 1200 MC; photo 13 illustrates the trace for measurement between 400 and 700 MC. The impedance variations on each trace are due to mechanical irregularities in the tested cable.

Note that there are decidedly less irregularities in photo 12, where the cable would meet a specification of 30 db (better than most cables).

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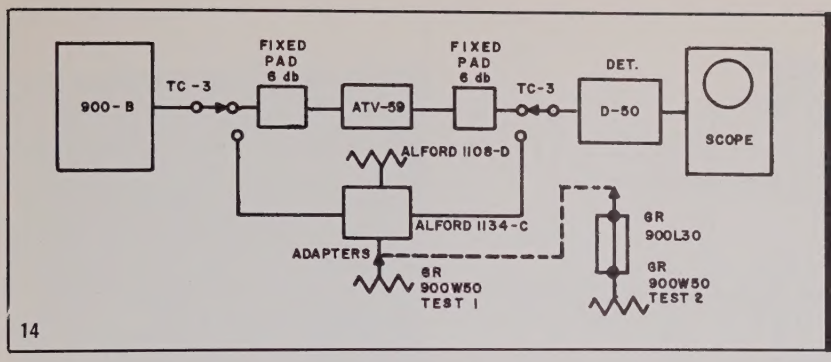

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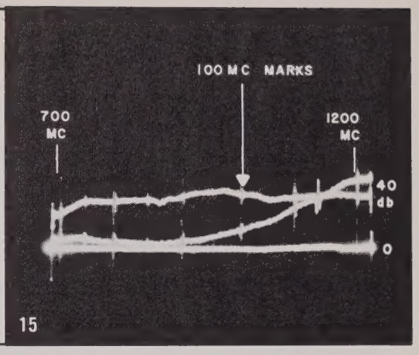


15

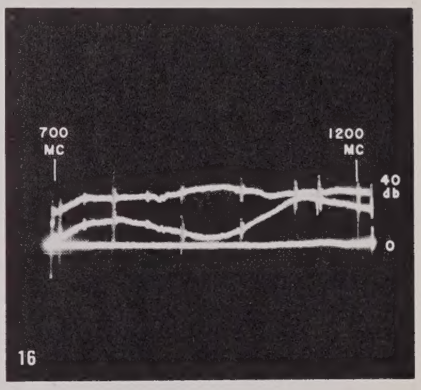
Application of Models TC-3 and ATV-50 in testing the sensitivity of Model 900-B and for checking the accuracy of the bridge test set-up.
Two tests were made:

1. connecting a General Radio type 900W50 precision 50-ohm termination through two adapters, first a General Radio type 900Q874, followed by a General Radio type 874QNP, to the bridge.

   Photo 15 shows that the bridge measured somewhat better than 40 db match (VSWR 1.02:1) up to 1100 MC.

2. connecting a 30 cm length of precise 50-ohm air dielectric line, General Radio type 900L30, between the termination and the 900Q874 adapter.

   If the characteristic impedance of the air line were exactly equal to that of the termination, the impedance would be unchanged in the second test. As seen in photo 16, there was a slight change, but the resulting impedance was still seen by the bridge as better than a 40 db match.



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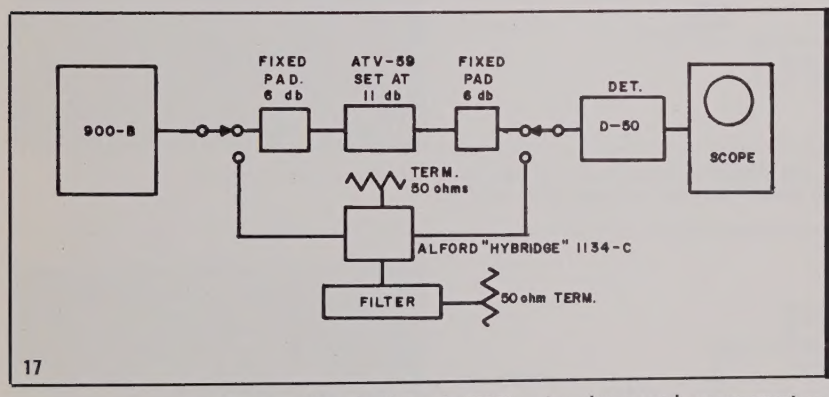

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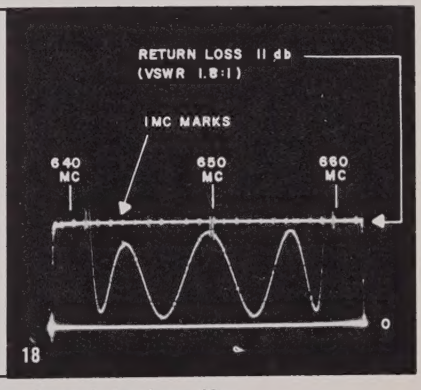
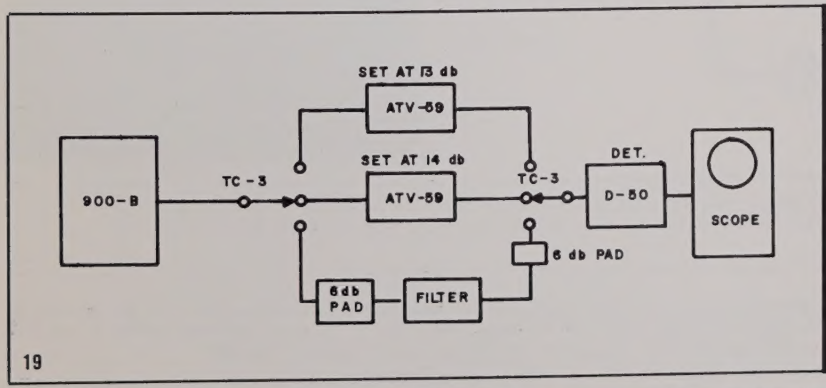


18

**Application of Models TC-3 and ATV-50 to impedance match measurement on a four-pole band-pass filter.**



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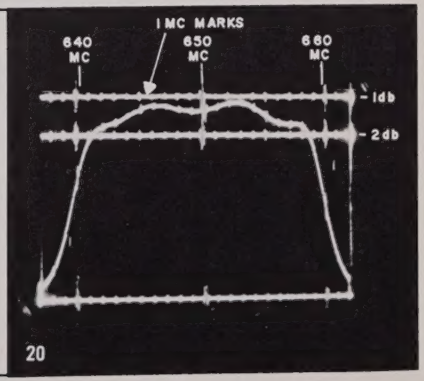
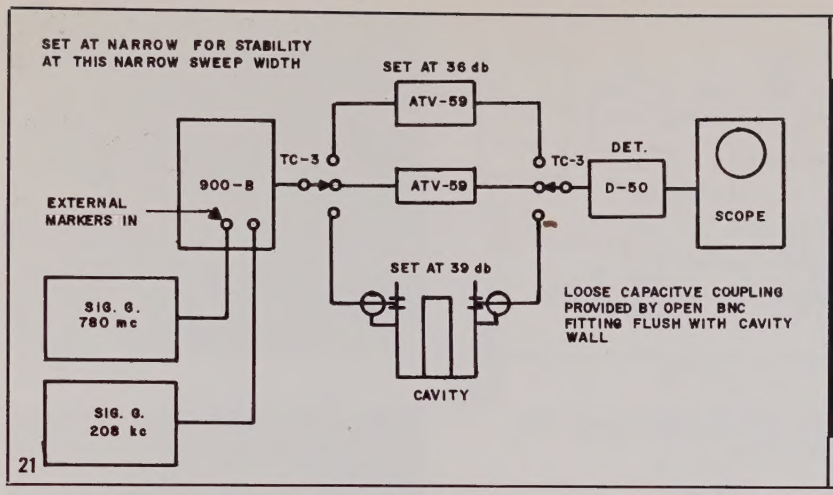
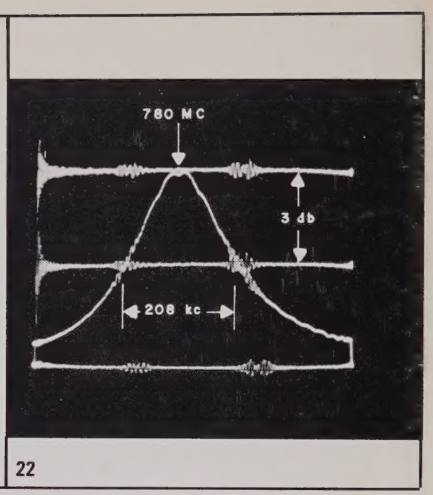


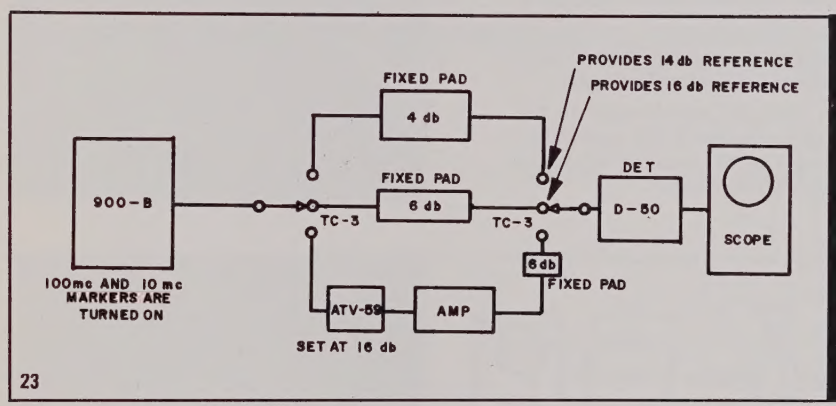
20

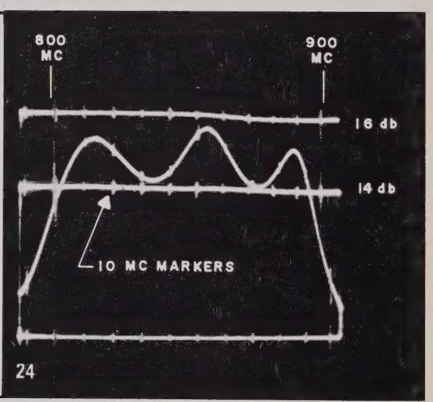
**Application of Models TC-3 and ATV-50 to measurement of insertion loss of filter the match of which was shown in photo 18.**



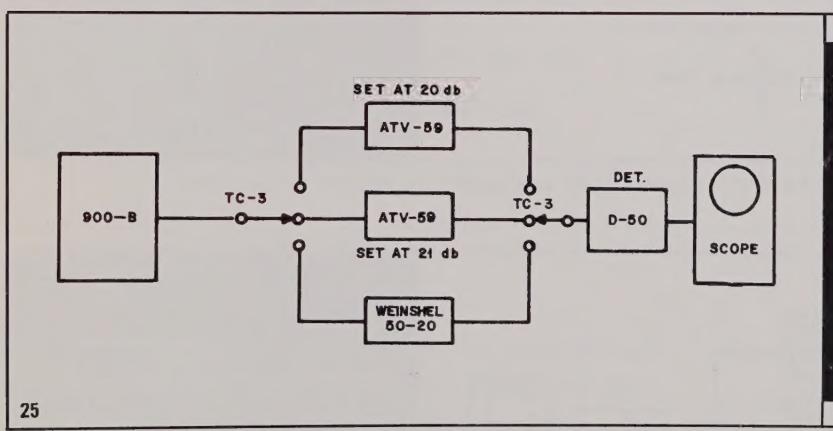



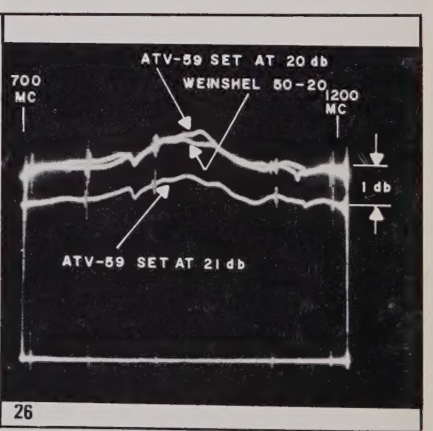

Application of Models TC-3 and ATV-50 to measurement of unloaded bandwidth and thus Q of 780 mc resonant cavity. Resulting $Q = \frac{fo}{\Delta f} = \frac{780}{0.208} = 3750$




Application of Models TC-3 and ATV-50 to measurement of gain of a transistorized UHF amplifier. Gain limits are 16 and 14 db; design bandwidth was 806 to 890 MC.




Comparison of Model ATV-50 with a Weinshel attenuator pad which had been calibrated at 20.0 db at 1000 MC. Differences between the two curves are about 0.1 db maximum, some of which is due to short cable jumpers.

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NOTE — Additional copies of this paper and engineering assistance on the application of Measurements By Comparison may be obtained by contacting the Industrial Products Division, Jerrold Electronics Corporation, 15th & Lehigh, Phila., Pa. 19132. Phone: BAldwin 6-3456 — Ext. 215.

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